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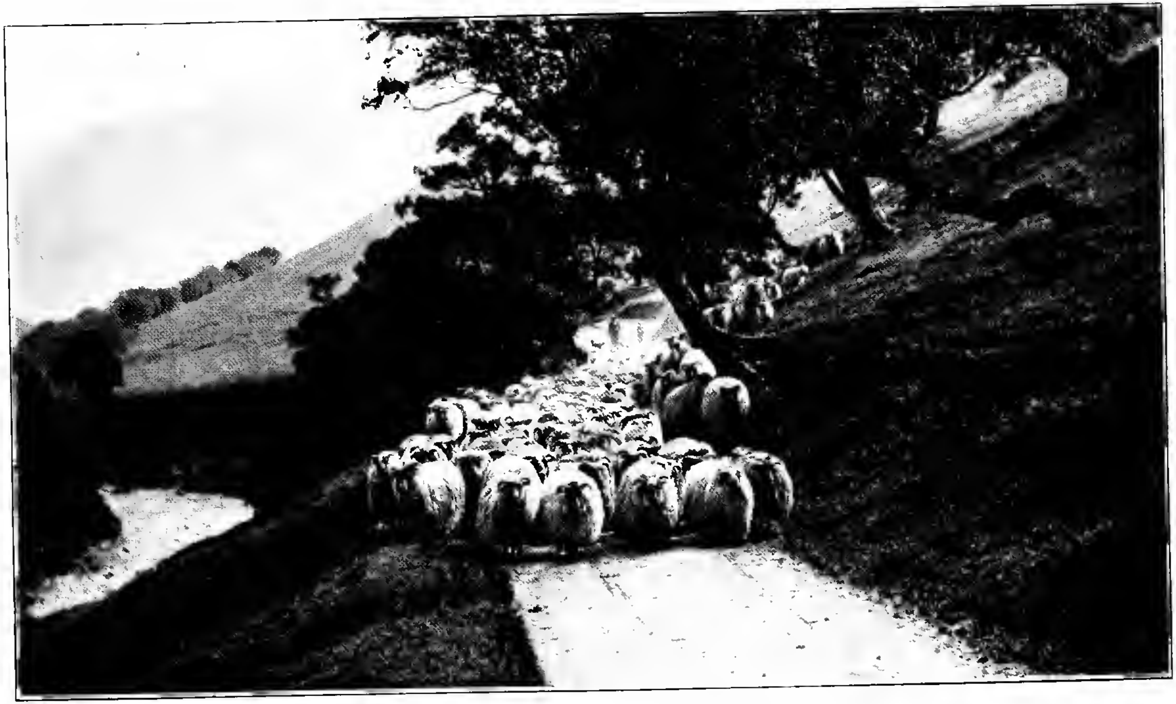

Black-Faced Highlands on Their Native Heath, Cheviot Hills, Scotland.

(See text, page 40)

VETERINARY MEDICINE SERIES
No. 12
Edited by D. M. CAMPBELL

SHEEP DISEASES

BY

E. T. BAKER, D. V. M.

ILLUSTRATED

Chicago
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1920

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PREFACE TO SECOND EDITION

The gratifying reception accorded this book has necessitated a new edition. An attempt has been made to keep pace with the rapid advances in ovine pathology. Several new chapters have been added; others greatly enlarged, and the constant aim has been to keep the work practical.

While the author is under many obligations to veterinarians, stockmen and others for their helpful cooperation, special mention should be made of the valuable assistance rendered by Doctors Newsom of Colorado; Lytle and Simms of Oregon; Welch of Montana; Nelson of Washington; Records of Nevada; Fredericks of Utah; Haring of California; Goss of Michigan; Dalrymple of Louisiana; Eichhorn and Hayden of New York; Alexander of Wisconsin; and Kinsley of Missouri. For much aid in preparing the chapter on poisonous plants by Dr. Pammel, of Iowa, and on parasites by Prof. Ransom, of the Zoological Division of the Bureau of Animal Industry. For the data on breeds to Professors Coffey of Illinois and Hickman of Idaho, and for corrections in the chapter on the wool industry, to Mr. W. T. Ritch, the noted Australian authority on wool, now of Utah.

Moscow, Idaho.
March 15, 1920.

E. T. Baker.

PREFACE TO FIRST EDITION.

As economical producers of those prime necessities of civilized man, good food and good clothing, sheep are destined to increase in numbers, and sheep raising to speedily attain and maintain a more important place in the animal industry of this country. Moreover, it being also a fact that of all domesticated animals sheep possess the least natural resistance to disease and particularly to parasitism, one may readily appreciate the importance of skilled veterinary service for the welfare of the sheep industry, now after more than a century's existence in this country, only at the threshold of its development.

It is unnecessary to emphasize the need for works dealing authoritatively with disease as it occurs in sheep and its treatment. That need is acutely realized by most veterinary practitioners. It is hoped that this treatise will to a degree meet the requirements of the searcher for practical information on this subject.

The major portion of the contents of this volume has been gathered from the field of experience and is presented solely from the viewpoint of the practitioner. To conserve the health and prevent disease among our flocks is a gigantic task, and one worthy of the highest attainments. To this task, in his limited field, have been devoted the best efforts of the writer, throughout the greater part of his veterinary experience.

Moscow, Idaho.
September, 1916.

E. T. Baker.

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CHAPTER I.

HISTORY OF THE BREEDS.

The word sheep is of unknown etymology, and the origin of the animal itself is veiled in obscurity as great. It is supposed that domesticated sheep originated from the wild forms of sheep, the "Mouflon," the "Musimon," and the "Argali."

The sheep is also one of the oldest of all domesticated animals; the different breeds are the results of environment, combined with man's ingenuity. For detailed histories the reader is referred to the various excellent texts on sheep management; space permits us to give only the briefest mention of the development of the sheep industry in this country.

No domesticated sheep were found in North America by the early explorers, and the wild Rocky Mountain sheep has never been tamed nor crossed with domesticated breeds.

For centuries, Spain controlled the fine-wool sheep of the world, and no exportations were allowed to other countries, until in 1765, when three hundred Spanish sheep were introduced into Saxony by royal favor, and became the foundation stock of the Saxony Merinos. In 1783, the French government imported Spanish sheep and established them on a farm near Paris, called Rambouillet, progenitors of the breed of that name.

During the first quarter of the nineteenth century Merinos were introduced into the United States. In 1801, the wool industry, that has made that state the leader of fine-wool sheep, was started in Ohio. The same year a number of Rambouillets were sent to New York by Robert Livingstone, our minister to France. In 1802, General Humphries, our minister to Spain, sent to his native state, Connecticut, nearly one hundred head of pure-bred Merinos. In 1809, William Jarvis, our minister to Portugal, sent four thousand pure-bred Merinos to Vermont. The next two years, it is estimated, nearly twenty thousand sheep were brought to this country and the industry thus started on foundation stock of the best blood.

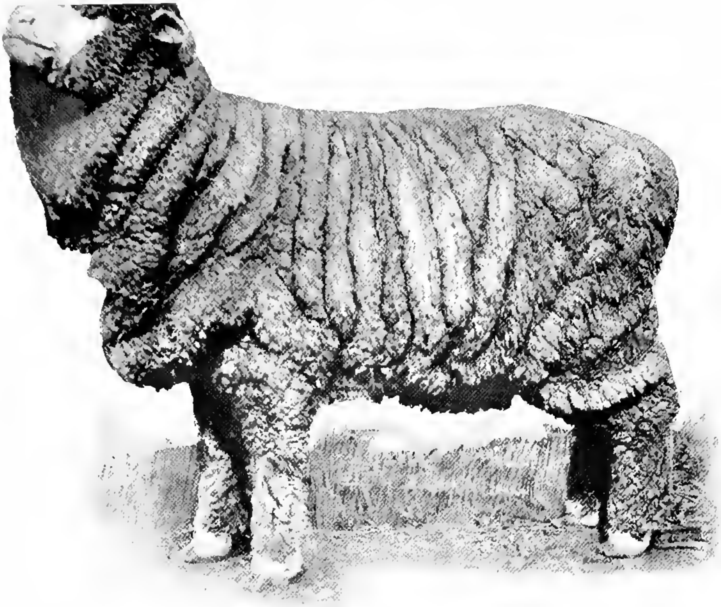
Due to the low altitude and moist climate of England, the Merino breeds have never done well in that island, and, as a result, the attention of breeders, particularly of Robert Bakewell, was early given to improving the mutton qualities of their sheep. All of our breeds of medium and long-wool sheep, chiefly of the mutton types, have originated from strains long bred in England for their mutton producing qualities.

In all countries of the world the sheep industry has flourished and has produced untold wealth for the owners. While it is a far cry from the times of Abel and Abraham, and the shepherds with their little flocks on the Chaldean hills in Biblical story, to the present day of gigantic sheep ranches of Australia, Argentine and the United States, the habits of this docile animal have remained practically the same as at the dawn of civilization.

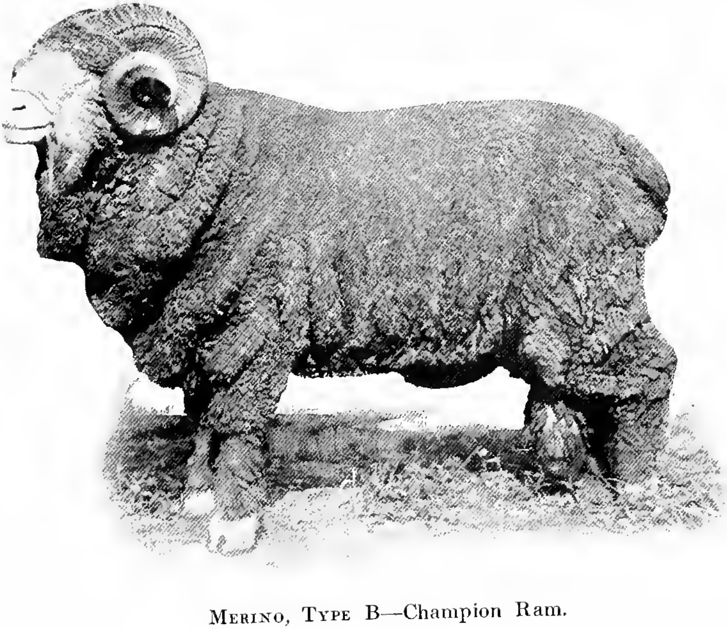
Courtesy American Sheep Breeder

Musimon of Europe.

In round numbers, there are about six hundred million sheep in the world, divided as follows:

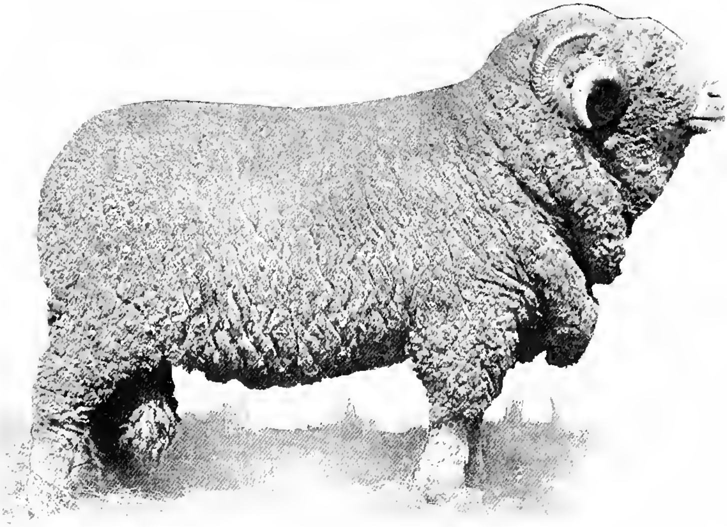


Merino, Type A—Champion Ewe.

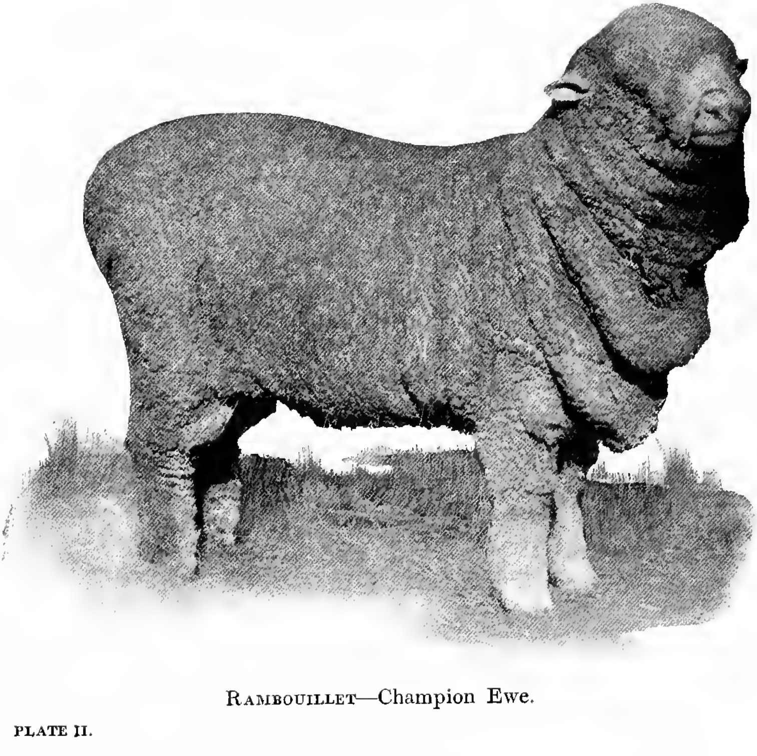


Merino, Type B—Champion Ram.

PLATE I.



Rambouillet—Champion Ram.



Rambouillet—Champion Ewe.

PLATE II.

60,000,000 head in North America, the United States, Mexico and Canada leading in order named.

120,000,000 in South America, the great majority being found in Argentine, Uruguay and Chile.

Courtesy American Sheep Breeder

ARGALI.

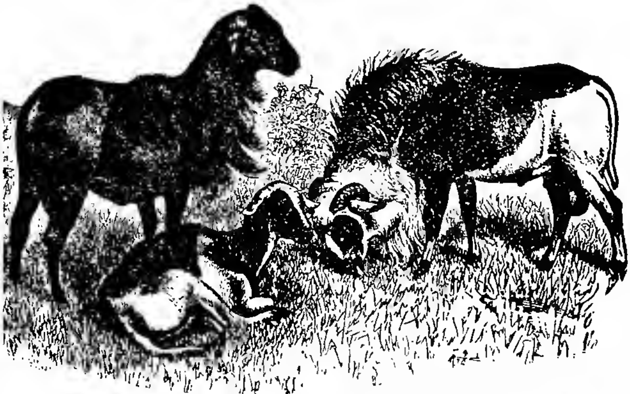
130,000,000 in Europe, the leading sheep raising countries being European Russia, Great Britain, European Turkey, France, Spain and Austria-Hungary.

115,000,000 in Asia, Asiatic Turkey, Asiatic Russia and India leading.

60,000,000 in Africa, South Africa and Algeria, producing nearly two-thirds of the total.

115,000,000 in Asia, Asiatic Turkey, Asiatic Russia and India leading.

60,000,000 in Africa, South Africa and Algeria producing nearly two-thirds of the total.



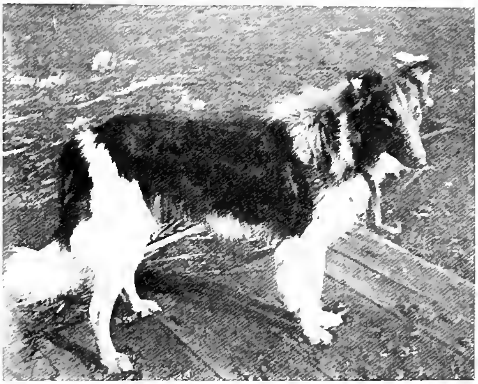
Courtesy American Sheep Breeder

AFRICAN SHEEP.

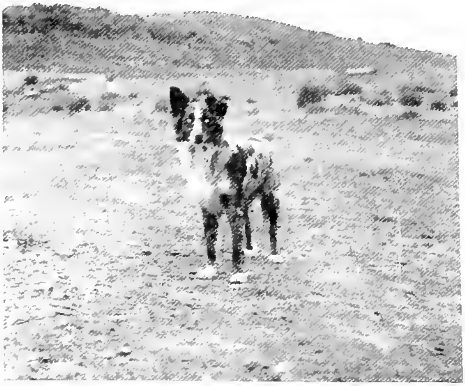
115,000,000 in Oceanica, Australia and New Zealand leading.

The three foremost sheep producing countries in order named are Australia, Argentine and the United States.

In these days of inventions and improvements, no substitute for wool has ever yet been devised. The sheep remains the only machine that can transform the forage from deserts and forests into fleecy wool and delicious mutton, and it will thrive where other animals starve to death. Its chief disadvantage is its very



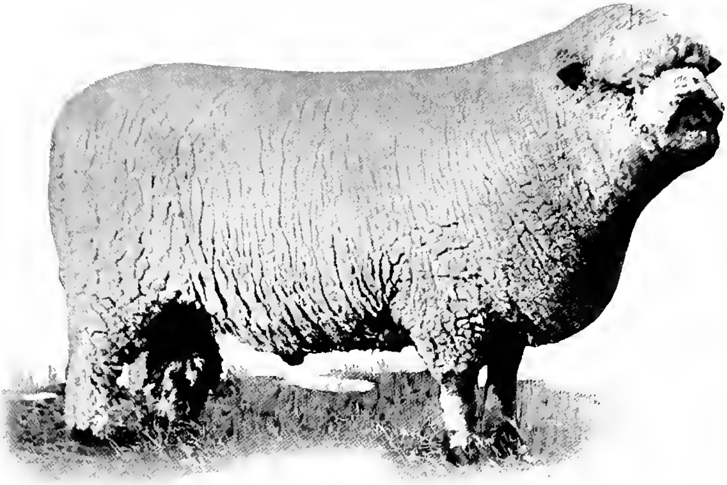
The Shepherd's Assistant.
The well-trained sheep dog, with almost human intelligence, is indispensable.



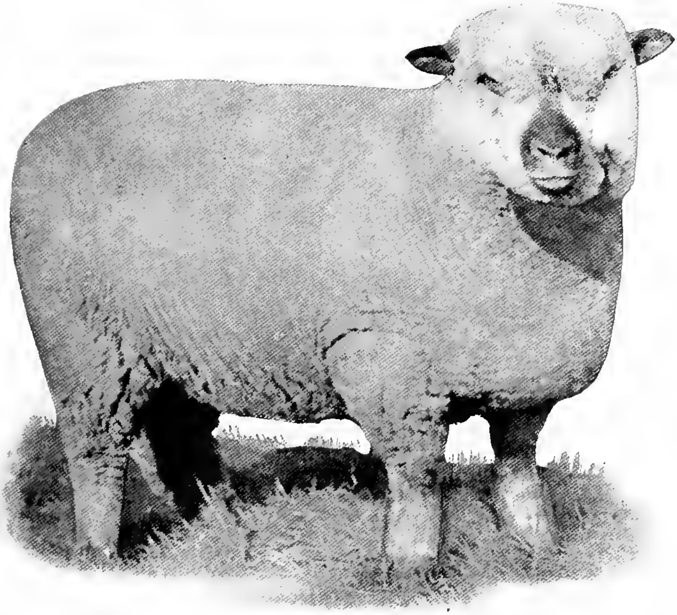
Western Sheep Dog.

feeble resistance to parasites and diseases, the prevention of which is the greatest task of the shepherd.

The classification of the breeds according to the fineness of

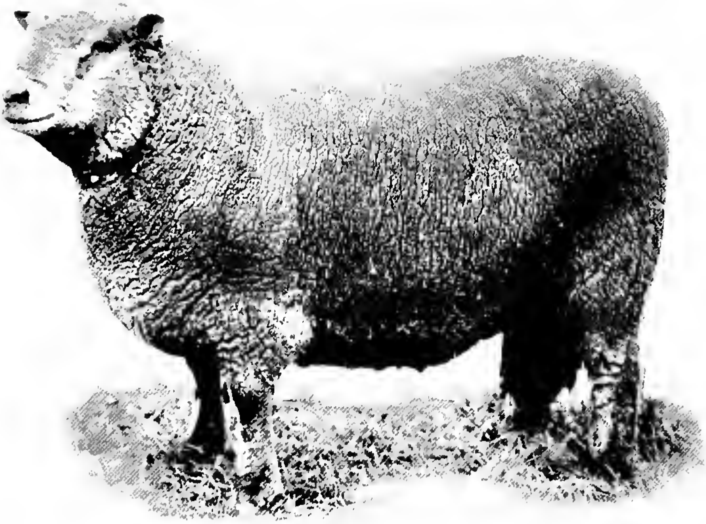


Shropshire—Champion Ram.

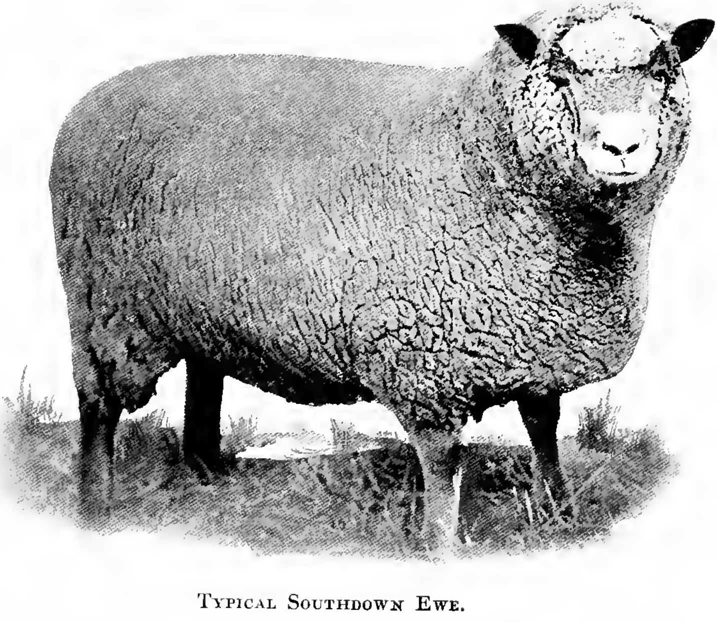


Shropshire—Champion Ewe.

PLATE III.



Typical Southdown Ram.



Typical Southdown Ewe.

PLATE IV.

the wool-fiber seems to be the common custom, the three classes being:

1. The fine-wool.
2. The medium-wool.
3. The long-wool.

A convenient table is as follows:

LENGTH OF WOOL

FINE
Merino

MEDIUM
Shropshire
Southdown
Oxford
Hampshire
Cheviot
Dorset
Suffolk

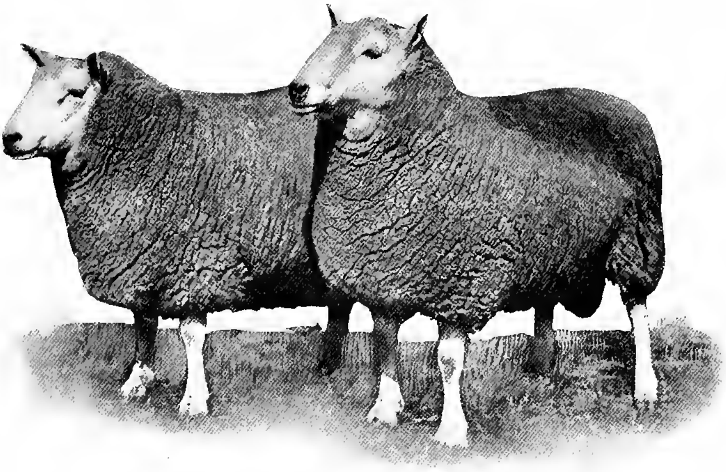
LONG
Leicester
Lincoln
Cotswold

COLOR OF FACE

LIGHT-FACED
Merino
Cotswold
Dorset
Leicester
Lincoln
Cheviot

DARK-FACED
Shropshire
Southdown
Hampshire
Oxford
Suffolk

In this country, the Merino blood, crossed with medium and long-wool rams, has been extensively used.

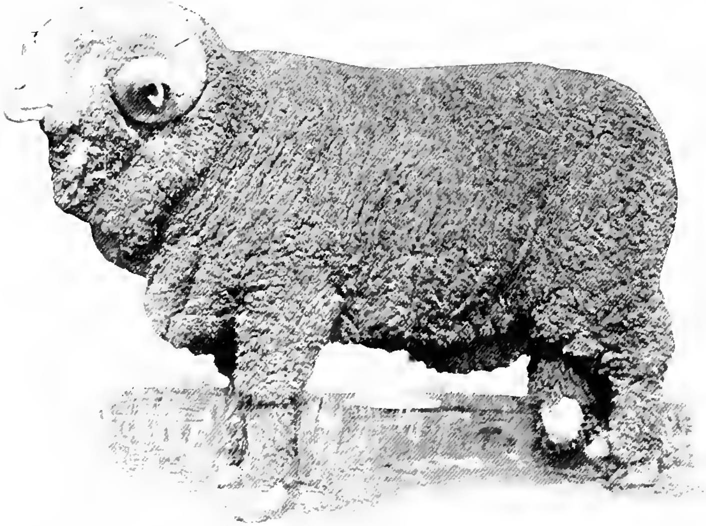


CHEVIOT—Ram and Ewe.

I. THE FINE-WOOLS.

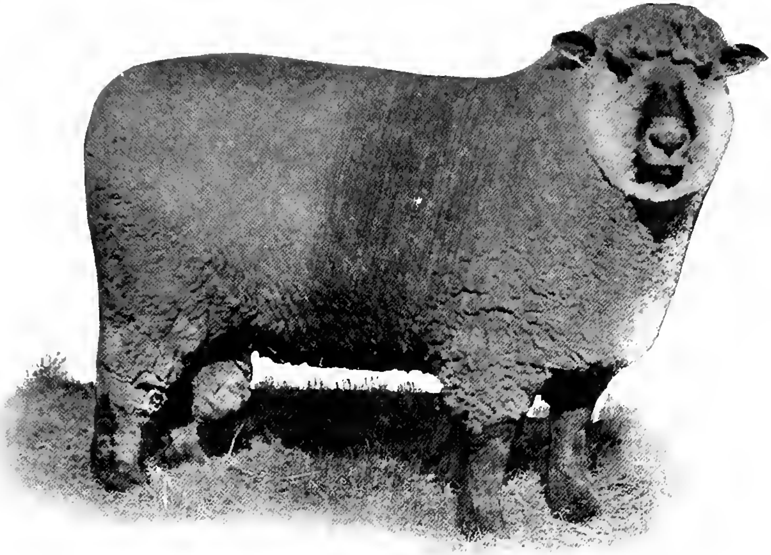
Merino.

This well-known breed seems to have been known in Spain since the earliest records. It is supposed they were brought to Spain from Italy, where they had been taken by a band of Grecians to the city of Tarentum. From the eighth to the thirteenth centuries under the regime of the Saracens and Moors, the wool industry flourished in Spain. As previously stated, no exportations were made from Spain until 1765, when the Elector of Saxony secured three hundred Merinos and bred them so carefully that they constitute a famous branch of the Merino, called the Saxony Merinos.

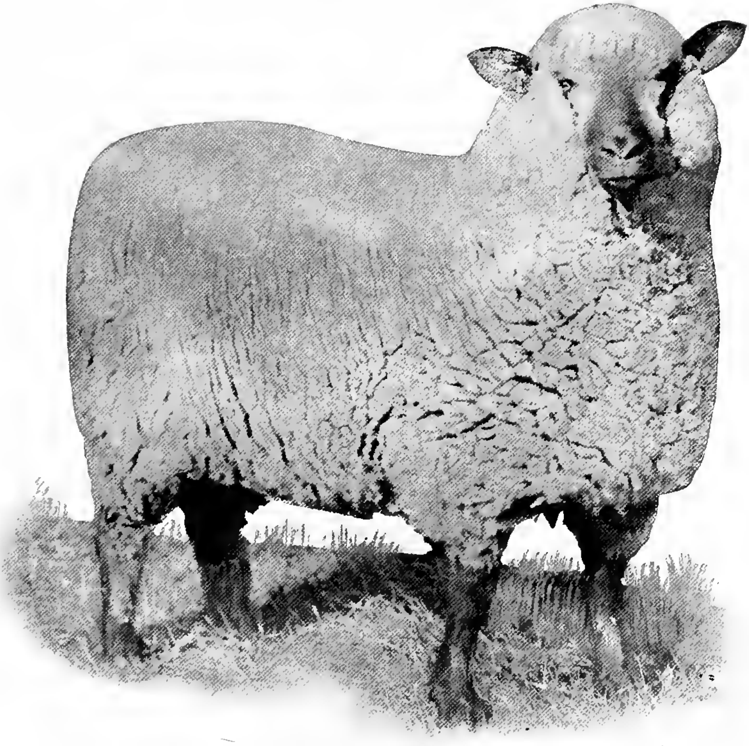


Merino, Type C—Champion Ram.

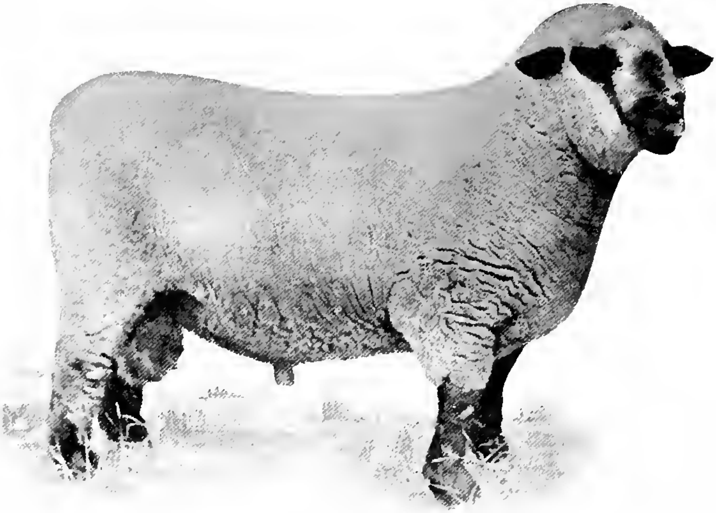
In 1783, France imported a large number of Spanish Merinos and placed them at Rambouillet, near Paris, and there created the breed known as Rambouillets. Von Homeyer, of Pomerania, Germany, improved this type so much, that a special breed known as the Von Homeyer Rambouillets resulted. This type was brought to Ohio in 1851, and has since flourished.



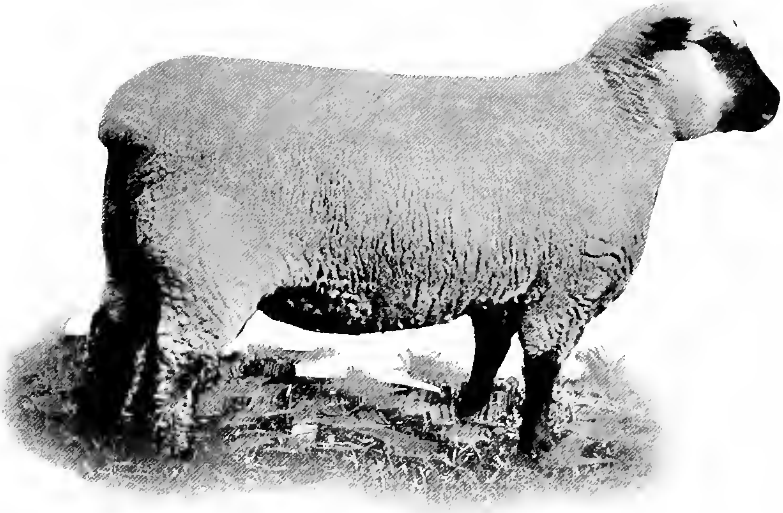
Oxford—Champion Ram.



Oxford—Champion Ewe.



Typical Hampshire Ram.



Typical Hampshire Ewe.

PLATE VI.

RANGE RAMBOUILLETS.

Many other types of the Merino have been developed in this country, among them being the Standard Delaines, National Delaines, Improved Delaines, Dickinson Delaines, and Blacktop Spanish Merinos.

At the present time it is customary to divide the Merino into three classes:

Class A: The extreme wool production type. The entire body is covered with folds and wrinkles, and there is an abundance of yolk in the fleece.

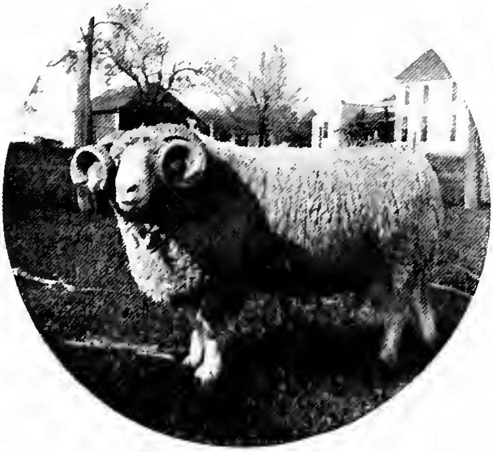
Class B: The body is not so wrinkled, which makes the shearing easier. It is the commercial type for wool production. This does not include the Rambouillet.

TYPICAL RANGE SHEEP.

Class C: This type has a longer fiber and the skin is nearly free from folds. These are better mutton producers than the two above-mentioned types. It includes the Delaine Merino.

The Rambouillet.

The Rambouillet is smooth-bodied, except for a few wrinkles on the neck. The rams have large, spiral-shaped horns; the ewes are hornless. This breed is larger than the Merino, but its wool is not so fine.



Dorset—Valley View Farm, Wasco, Ill.

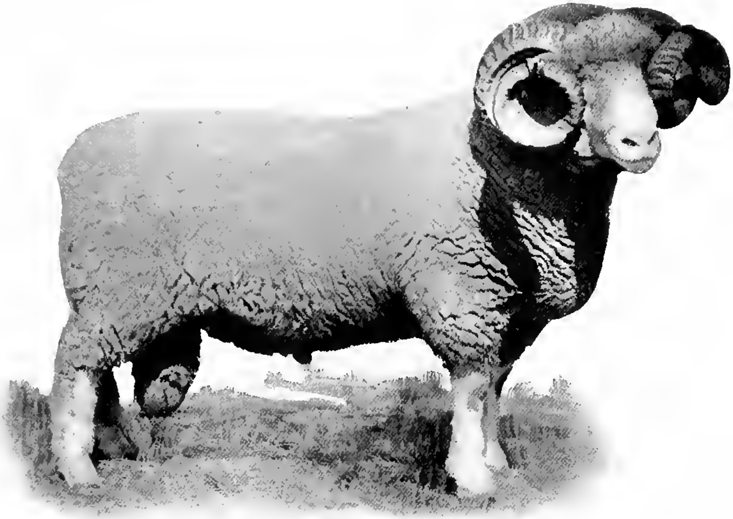
II. THE MEDIUM-WOOLS.

Shropshire.

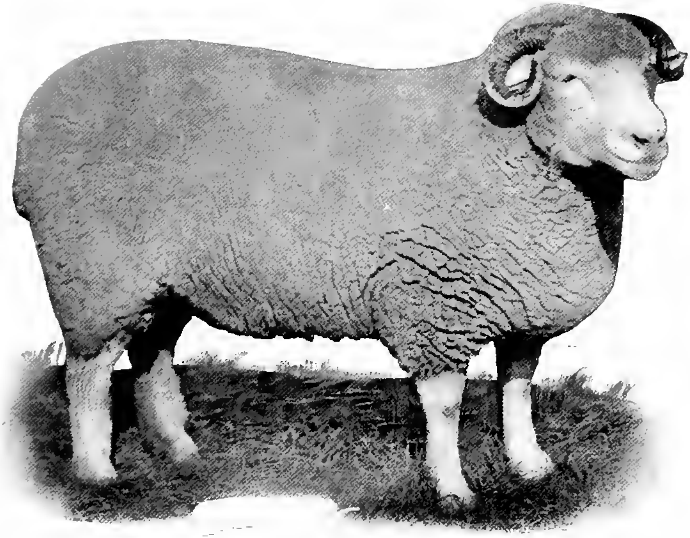
This breed was first recognized in the early fifties of the last century, and was brought to perfection in the central counties of England. It is one of the most popular of all western range sheep, the "Shrops" being a general-purpose breed.

Quick to mature, hardy, good mothers, prolific breeders, easy feeders and good rustlers, they have attained their position by their sterling qualities. They are medium in size, and cross well with other breeds. They are dark-faced.

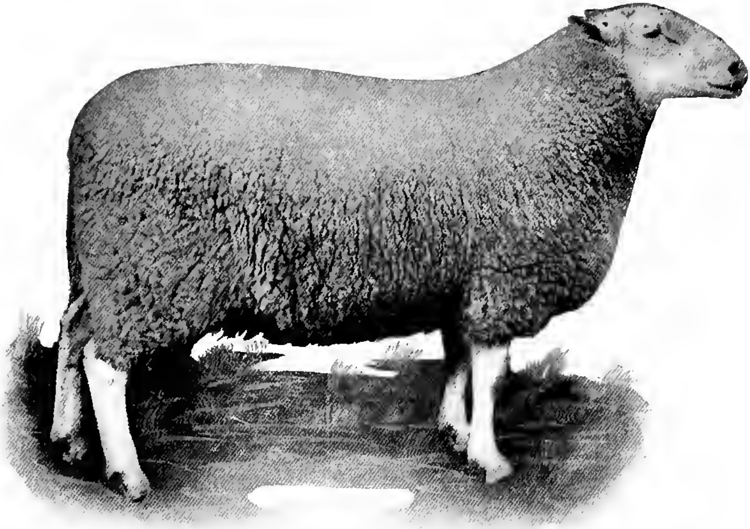
The first Shropshires were brought to this country in 1833. They were taken to Ohio.



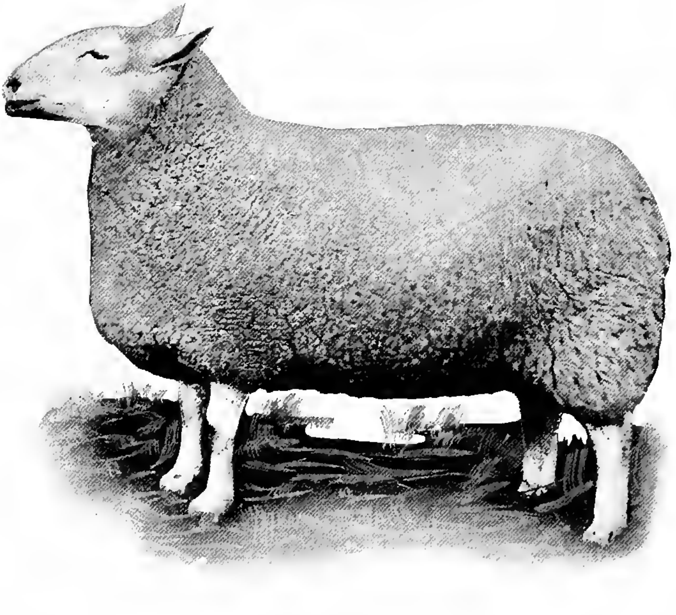
Dorset—Champion Ram.



Dorset—Champion Ewe.



LEISCESTER—Ram.



LEISCESTER—Ewe.

PLATE VIII.

Southdown.

This is also a dark-faced, medium-wool breed. It is perhaps the oldest of the British types, its history dating back for many centuries.

They are noted for their low, compact bodies, with small bone, and excellent wool. As a mutton sheep they are unexcelled.

Some claim specimens of this breed were brought over with the Pilgrims, and that as early as 1688 they were found in Virginia. In 1803 a small flock was imported into New York, and in 1824 to 1825 many more were imported.

Typical Tunis Ram.

Oxford.

The Oxford originated from crossing Cotswold rams on Southdown and Hampshire ewes. This was begun in about 1830, and in 1861 they were recognized as a distinct breed.

They are very large and mature quickly. They yield the heaviest fleece of any of the Down breeds, fifteen pounds being a common average. It is an excellent small-band sheep, consuming large quantities of food and making good gains. As a foraging sheep it is inferior to the Shropshire. It is dark-faced.

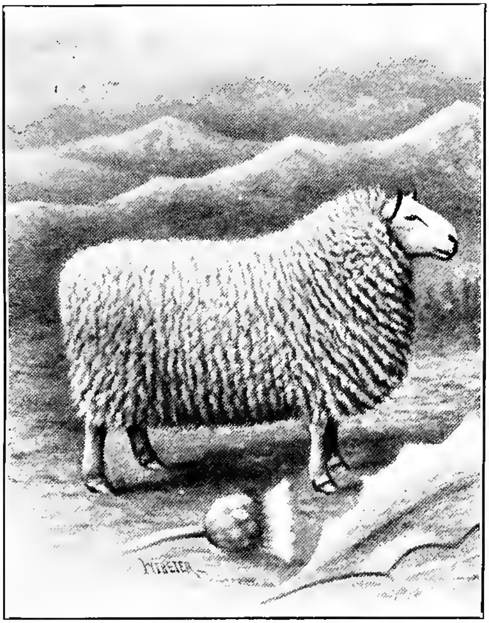
Typical Western Sheep Owner's Home of Twenty Years Ago.

Homes Like This Are Very Common Among the Sheep Men Now.

Hampshire.

This breed was evolved from sheep raised in Hampshire and Wiltshire, England, crossed with Southdown rams. Some claim Cotswolds also were used in the cross. The breed is over one hundred years old, and is a very popular one where food is abundant. It makes larger gains than any other Down breed during the first part of its life.

The wool is not heavy. The ewe is very prolific, and the lambs of such quick growth that they make an excellent "hot-house" variety for early markets.



Courtesy Dotshome Farms.

CHEVIOT.

Cheviot.

The Cheviot acquires its name from the Cheviot Hills on the boundary between England and Scotland. This breed is as old as the earliest records. They are great foragers, resembling the Shropshire in this respect. On account of the strife and "Border Wars" resulting from the frequent disagreements between English and Scottish chiefs, the breed was not improved for centuries. With long bodies, they were adapted for mountain ranging, and were known as the "long sheep." Crossing has given them better conformation. They are excellent wool and mutton producers, good foragers, and are gaining in popularity. Their beauty and alertness have contributed not a little in this.

Dorset.

This breed is white-faced; it is peculiar in that both ram and ewe have horns. The Dorsets seem to have sprung from a breed common in the southern and central parts of England since the earliest times. The county of Dorset was especially famed for this kind of sheep, hence the name. About 1862 they were recognized as a distinct breed.

Their great prolificacy renders the Dorsets valuable for intensive farming; two lambings a year, and frequently twins, is the record. If only one crop of lambs is raised, the Dorset ewe will come in season very early, and produce lambs for the "hot-house" trade.

Suffolk.

The progenitors of this breed were known as the Norfolks, and thrived in southeastern England. They are hardy and good rangers. Along in the early part of the last century they were improved by crossing with the Southdowns; in 1859 they were recognized as a distinct breed.

This animal is somewhat smaller than a Hampshire but larger than a Shropshire. The lambs are usually black. They are not well known in this country.

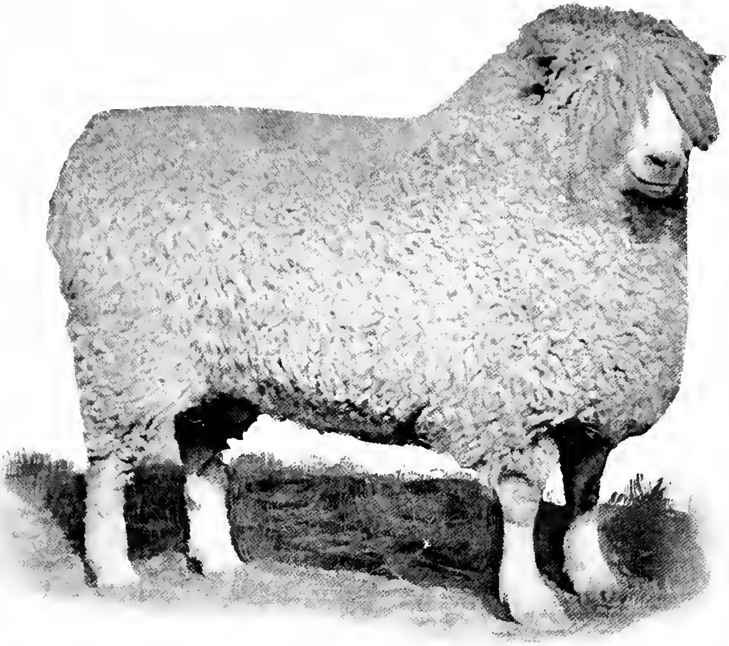
III. THE LONG-WOOLS.

Leicester.

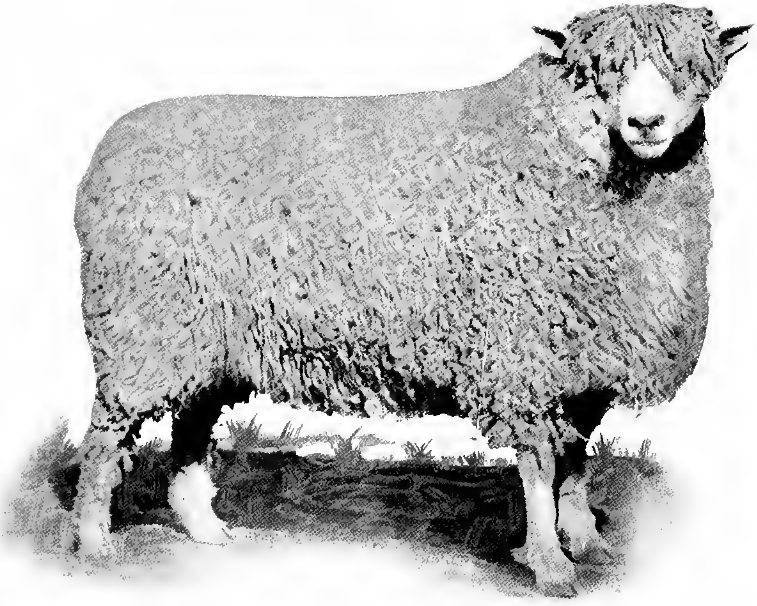
About 1755 Robert Bakewell, the famous agricultural genius of England, began to mate well-formed sheep found in Leicester county. Soon he had made a notable improvement, and a new breed came into being, known as the Leicester (pronounced les′-ter).

The body is excellent in shape and smoothness, but the lightness of wool on the belly and length of legs gives it a somewhat "leggy" appearance. The original animal, as Bakewell bred it, was not hardy, since he sacrificed constitution and stamina for shapely type.

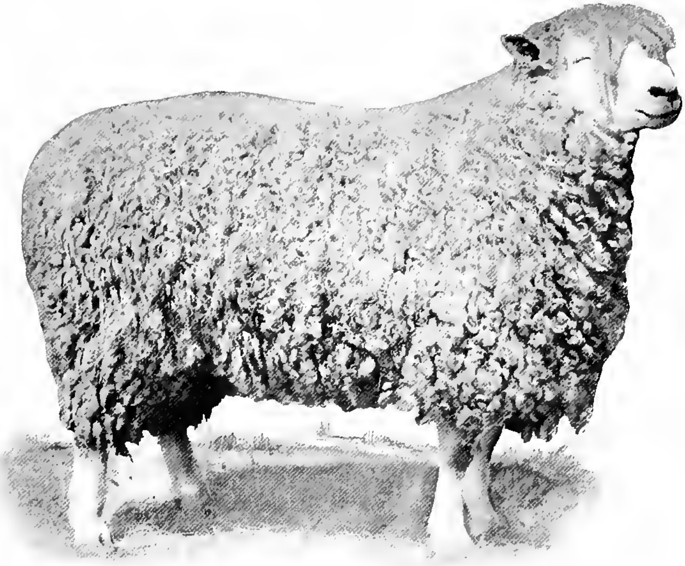
Their excellence consists in fattening quickly where food is abundant. For this reason the Leicester ram is often used for crossing on other breeds where early fat lambs are desired.



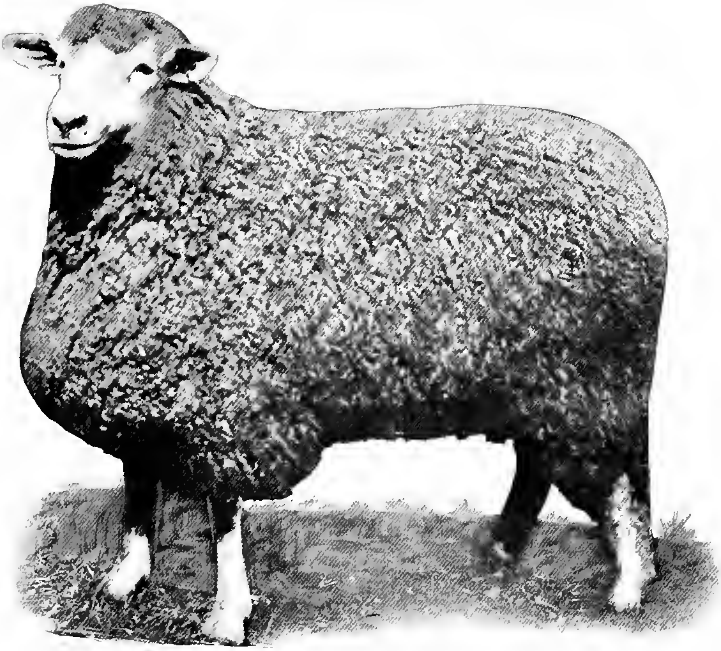
Cotswold—Champion Ram.



Cotswold—Champion Ewe.



LINCOLN—Champion Ram.



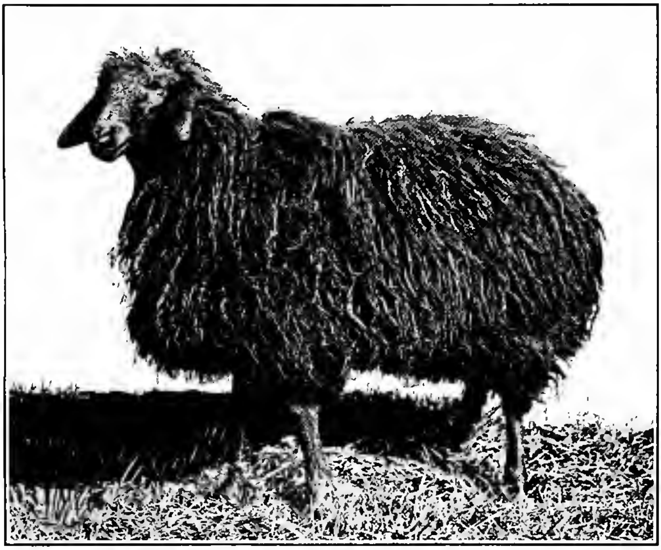
LINCOLN—Champion Ewe.

PLATE X.

The Border Leicester was originated by Cully, who secured Leicester rams from Bakewell and crossed them on an old long wool breed, called the Teeswaters. The head of the Border Leicester is free from wool, while the Leicester has a tuft.

Cotswold.

The Cotswold is said to have originated from two words: "Cotes," referring to the barn in which the sheep are kept, and "wold," to an open, rolling upland range. The early history of this breed is veiled in obscurity, although it is claimed they were found in England when Caesar visited the island.



KARAKUL—A Fur-bearing Sheep.

Some authorities claim the present breed is the result of crossing the original Cotswold with Bakewell's improved Leicesters. This cross reduced the size, increased the mutton quality, and lessened the resistance to disease.

The Cotswold is a large, massive appearing sheep, with long wool, fine in fiber. A valuable feature of this breed is its prepotency. In crossing with other breeds it unfailingly transmits its tendency to increase the size and the weight of the fleece. It is a valuable breed for intensive farming.

Lincoln.

This is another ancient breed, improved to their present high standard by crossing with the Leicesters. The original breed was found in Lincolnshire, England, hence the present name. In 1862 they were recognized as a distinct breed, and have been extensively imported into the United States and Canada.

On the Western Range.

This is the largest breed of sheep, being massive, strong boned, and yielding heavy fleeces. They are extremely popular in crossing on Merino ewes; the progeny have a fine, large, lustrous fleece.

A Portion of a Band of 3,000.

In the West, they are valuable small ranch sheep, giving great returns in wool, mutton and lambs.

LESSER KNOWN BREEDS.

Romney or Kent.

This breed originated in southeastern England, and some splendid specimens are found in this country. Their chief use on the range is to cross on the Merino. They are white-faced.

THE BELL WETHER.

Corriedale.

These sheep were recognized as a distinct breed in New Zealand about 1911. They originated from crossing Lincoln rams

PANAMA SHEEP IN IDAHO.

on Merino ewes. They are highly thought of as wool and mutton producers, especially for the frozen meat trade. They are becoming more extensively raised in the United States, several fine bands being found in the West.

Karakul.

Karakul sheep in small numbers have been imported into the United States. This is a fur-bearing animal, a native of Bokhara, a Russian dependency, and, due to the laws of this little country, forbidding any exportations of sheep, are little known outside of their native heath. They have been crossed with various other breeds, such as Merinos, the progeny being called "Karakul Finewools," and with Persians, the cross being known as "Karakul Persians." The latter cross produces very fine skins.

The Black-Faced Highland.

This breed is an inhabitant of the Cheviot Hills, and is also known as the Black-faced Heath. It is of the long-wool type. (See Frontispiece.)

Tunis.

The foundation stock for this breed was imported from Africa over a century ago, but the Civil War almost destroyed it. The distinguishing mark is an exceedingly long, fat tail, and a hornless head covered with tawny, brown hair.

Persian.

Persian sheep were introduced into this country some years ago. When crossed with Merinos they have done well in the arid regions of the west.

Cross-Bred Sheep.

Cross-bred sheep are commonly raised by range men who desire a hardy animal, combining the qualities of several breeds. The commonest crosses are the long-wools, such as the Lincoln and Cotswold, on the Merino. Other well known crosses are the Shropshire and Hampshire on the Merino. Due to different range conditions, a cross successful in some parts of the country may prove valueless in another. Arguments about the "best breed" or the "best cross" are but a waste of time; the desideratum being ultimate profit. The Panama is one of this type, and is an Idaho production. It is the result of crossing Rambouillet rams on Lincoln ewes, and, it is claimed, the progeny are a large, dense-fleeced class of animals.

CHAPTER II.

THE WOOL INDUSTRY.

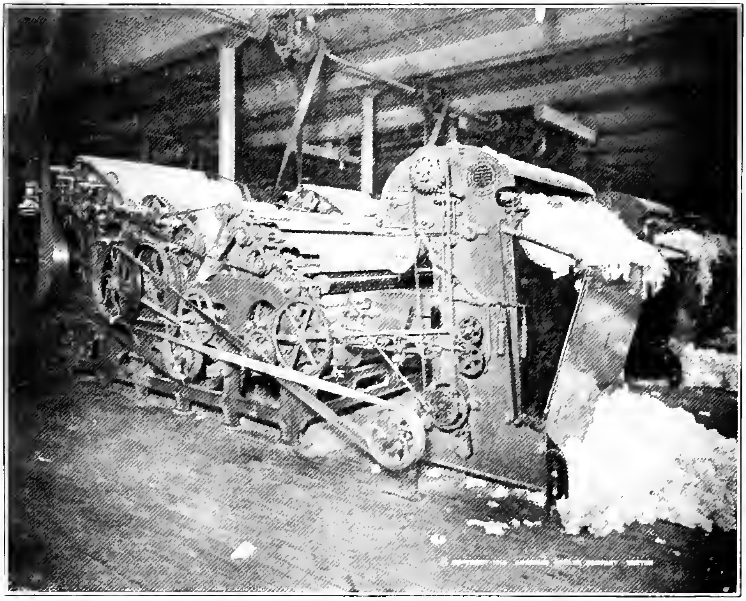
Very few realize the vast extent of the wool industry. The world's production of wool amounts to over two and one-half billion pounds annually. Of this, Europe produces nearly 800,000,000 pounds; Australia and New Zealand over 655,000,000 pounds; South America nearly 480,000,000 pounds; North America nearly 305,000,000 pounds; Asia 270,000,000 pounds, and Africa over 207,000,000 pounds.

Courtesy American Woolen Co.

Sorting Fine Australian Wool—The Fleeces Are Sorted According to Their Spinning Qualities.

The United States produces barely 270,000,000 pounds annually, while the demand requires nearly 600,000,000 pounds. Military needs so augment the demand, while a lack of shipping so curtails imports, that everyone is familiar with the scarcity of wool in wartime. It will thus be seen that even in normal times of peace, sheep husbandry will always occupy an important place in our industries.

There are over nine hundred woolen establishments in this country, with a capital of over one-half billion dollars. Some 160,000 employes are engaged in this industry, and the products manufactured amount to over four hundred million dollars. To produce this vast amount of textiles and by-products, over 49,000,000 sheep, valued at nearly five hundred million dollars, are raised, and even these produce less than half the annual consumption.



Courtesy American Woolen Co.

Carding Machine—Carding Wool in Preparation for Spinning.

The Wool Fiber.

A fiber of wool consists of three parts:

1. Epidermis or outer covering, composed of a series of plates or scales.
2. Cortex, or the structure proper, consisting of angular cells.
3. Medulla, or pith.

The chief difference between wool and hair is in the epidermis, and it is due to these fish-like scales that it is possible to "felt" wool. This process is merely an interlacing together of the many fibers, which, on account of their microscopic scales interlocking, form a comparatively strong strand. The first mechanical invention for producing felt was brought out in America in 1820.

Courtesy American Woolen Co.

Spinning Wool Into "Worsted" or "Woolen" Yarn.

Wool fiber is one-fourth stronger than cotton fiber. The average composition of wool consists of the following:

Carbon	51.8
Hydrogen	7.2
Nitrogen	18.5
Oxygen	20.3
Sulphur	2.2
	100.0

This varies greatly, even among sheep of the same breed. The three principal classes of wool are:

1. Warp staple, 2.5 inches in length and over.
2. Standard combing, slightly over 2 inches in length.
3. Clothing, short, irregular and tender wools.

Of course, technically speaking, there are many other classes, but as space forbids going into details of the textile art, only a general and brief description will be given.

Some "clothing" wool is known as "French combing" wool, while the shorter staple is known as "carding" wool. "Combing" wool is prepared by combing the fibers parallel, while in the carding wool the fibers cross and interlock in all directions, making a very strong weave. Spinning consists in merely twisting the fibers into one thread or strand.

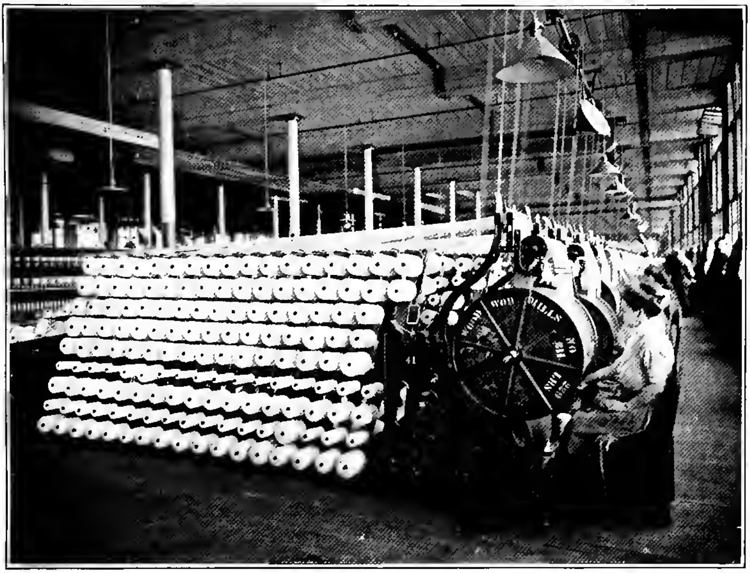
Grades of Wool.

The common grades of wool are many, and the names are puzzling to the uninitiated. "Braid" is secured from pure-bred Cotswold or Lincoln ewes. "Low ¼ blood" from grade Cotswolds or Lincolns, with Merino blood; "¼ blood" from cross-bred ewes, with ¼ Merino blood; "blood" from Merino blood, Shropshires and Hampshires; "½ blood" from half-Merino blood, such as the Corriedale or Panama; "Fine Medium" from nearly pure-bred Merinos or Rambouillets; "Bucks, fine" from Merino or Rambouillet rams; "Bucks, Braid" from Lincoln or Cotswold rams; "Black" from any grade black sheep; "Tags" broken or filthy pieces; "Locks" fragments and sweepings.

Many trade names are given wool, which to the experienced, give its entire history. For example, a bale of Australian wool may be termed "Sydney" or "Adelaide" wool. European wools may be subdivided into "Saxony," or "Russian" or "Shetland". From Africa may come "Cape" and "Natal" wools. From Asia the bale may be labeled "Cashmere." South American bales may bear the name "Buenos Aires" or "Montevideo," while our own wools may be called "Delaine," "Braid," "¼ blood," or may gain their names from their point of origin, such as "Oregon," "Territory," or "Ohio." This system corresponds to calling a certain horse a Percheron; the name immediately calls up a mental picture of the animal. Its name gives a clue as to its origin, conformation, probable color and sphere of usefulness.

Shearing and Grading.

Shearing is performed either by hand or by power. The former process is more general among the small flocks, and an expert will clip from sixty to one hundred animals per day. The power plants are found mostly in the West, where one or more extensive sheep owners erect a shearing shed that is a marvel of modern efficiency. Here one man can easily clip over two hundred per day. The wool is scientifically classed or "graded", and baled according to the Australian system, and the plant soon pays for itself in better prices for the output.



Courtesy American Woolen Co.

BEAMING AND YARN INSPECTION.

From the manufacturer's standpoint, length of staple, evenness, fineness and strength constitute eighty per cent of perfection, while density, brightness and softness aggregate the remaining twenty per cent.

After shearing, the fleeces are baled and sent to some large "concentration center", or market, where buyers gather and make offers. Often the clips from several growers are pooled and sold as one lot.

Scouring, Carding and Combing

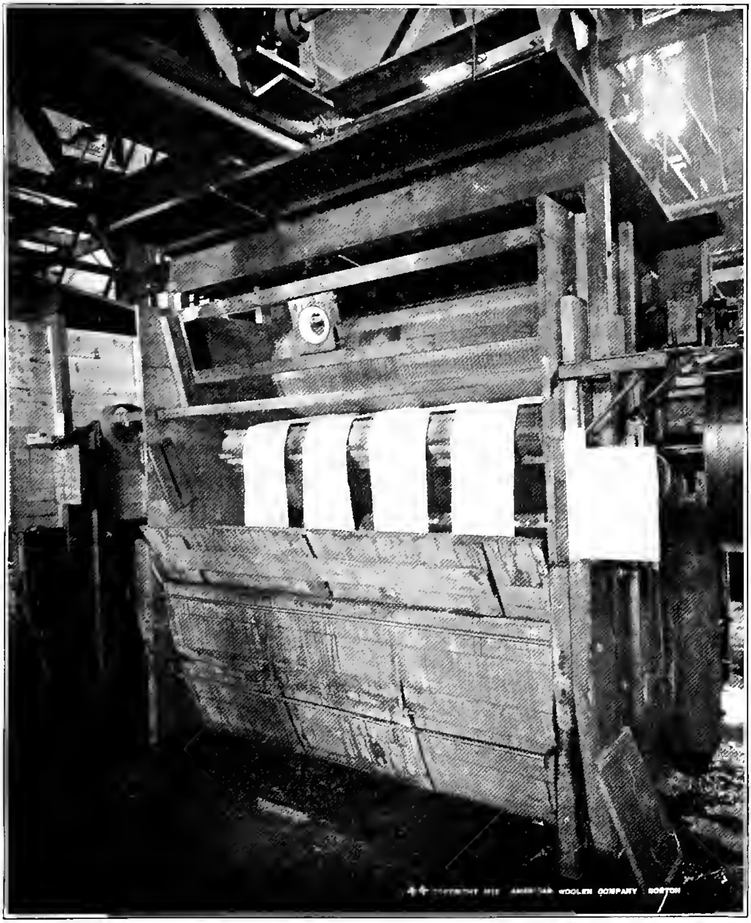
Arriving at the woolen mill, the bale is opened and the fleeces "sorted" according to their spinning qualities. The next step is washing, by which all impurities, such as the "yolk" or "grease" is taken out. In domestic wool, the average shrinkage amounts to 65 per cent. Thus a Merino fleece weighing 6.25 pounds "in the grease", as it comes from the sheep, will contain the following, on a scientific test:

Earth, sand and lime	17	ounces
Manure and dirt	8	ounces
Fat	14½	ounces
Water	13	ounces
Potash	4½	ounces
Sheep oil	8	ounces
Pure wool fiber	35	ounces
	100	

After the "scoured" wool has been dried, it is ready to be combed or carded for spinning into "worsted" or "woolen" yarn. When wool contains burrs and other vegetable matter it is necessary to carbonize it before the manufacturing process begins, and this extra expense is taken into consideration when it is bought from the grower.

Combing for worsted yarn is the process of drawing and laying the fibers parallel, while in carding for woolen yarn, the fibers run in all directions. The worsted is considered the stronger and also more suitable for dress fabrics.

The different kinds of carding machinery vary in minor details, but there are two distinct kinds of combing machines, the Bradford or English comb, and the Noble or French comb. Both these combing machines are used in every manufacturing center of the world, the names merely indicating their origin. These two machines give equally good results, with the particular kind of wool for which they are adapted. The Bradford comb is used for even, bright, standard staple wool two inches long or over, while the French comb is chiefly used for shorter wool with a staple of one and one-half inches or under. Short, irregular and tender-fibered wools cannot be combed in either of these two machines to advantage, and are therefore carded and afterwards spun into woolen yarn for clothing fabrics, as they are unfit for worsted fabrics. Clothing wools are worth on an average, fully seven cents per pound less than combing wools. The "noil" or short refuse from the combing machines is blended with short clothing wools and spun into woolen yarns. Shoddy



Courtesy American Woolen Co.

SCOURING CLOTH.

can be extensively blended with clothing wools, but worsted cannot be adulterated with shoddy or mungo. The French comb can blend wool and cotton tops for making "union" yarns for the hosiery trade, but the English comb is not adapted for mixing in this way. The long, even fibers drawn parallel by the comb and formed into a "sliver" for roving and spinning into worsted yarn is called the "top", and the short, irregular refuse for spinning into woolen yarn is called the "noil." Bradford tops are generally oiled to a slight extent before being spun, but French tops are spun dry. Bradford worsted yarns are chiefly spun on the "ring" spinning frame, while French yarns are mostly spun on the "mule" frame, as the latter possesses certain advantages for spinning short-fibered wool.

Manufacture of Woolens

Worsted yarn is measured by "counts", or the number of hanks to the pound, each hank containing 560 yards, while woolen yarn is measured by the number of "runs" to the pound.

After the yarn is wound on bobbins, it is transferred to the spoolers. Next, a "warp" is formed by spools placed on a creel. Then it is ready for the loom, where it is woven into cloth. Two distinct systems of thread are interlaced—the warp threads running lengthwise of the cloth, and the "weft" or filling threads out of the shuttle from side to side.

Many complicated processes are now gone through with before the cloth is ready to be dyed, and finally finished. A few of the well known kinds of cloth manufactured from wool are:

Broadcloth—a closely woven cloth with a satin finish, and one of the oldest known woolen materials used for clothing.

Cheviot—a cloth originally made from Cheviot wool for sporting and business suits, but many inferior imitations are now produced. The genuine is still made in Scotland.

Flannel—a wool fabric for underwear but sometimes made of a mixture of cotton and wool. Pure woolen flannel has a lusterless surface. This textile was originally made in Wales.

Homespun—made of coarse, uneven threads, on hand looms; of plain weave and with little or no felting—the clothes of our forefathers.

Serge—a cloth resembling flannel except it is twill woven, with a smoother surface. Woven from worsted yarns, after dyeing, it is pressed through metal rollers to give it luster.

Shoddy and mungo are woolen products used over and over again. Produced from old woolen rags, the process of manufacture consists in dusting, sorting, seaming, oiling, grinding and finally rolling to the required thickness.

Tweed is an unfinished fabric of soft texture, originally produced by the weavers on the banks of the river Tweed, in Scotland. It is now the usual term given to fancy mixture woolen clothes for business suits.

The military value of wool is of great importance. Without warm clothing, armies are helpless to face the elements, or to burrow in the earth as now required by modern warfare.

The average uniform contains between three and four yards of cloth, each yard containing from fourteen to eighteen ounces of wool. Add to this three woolen blankets, overcoat, woolen breeches, service coats, heavy underwear, woolen gloves, flannel shirts, woolen socks and other articles composed entirely or in part of wool, nearly one-half the expense of equipping a soldier goes for woolen goods. A conservative estimate is that the wool from twenty sheep will scarcely keep a soldier in active service for a year, so rough is modern usage in warfare. With armies numbering men by the million, wool assumes a place of vital importance in war time.

CHAPTER III.

ANATOMY.

The anatomy of the sheep greatly resembles that of the ox in general. A brief summary is as follows:

THE SKELETON.

Vertebrae.

The vertebrae are forty-nine to fifty-one in number: seven cervical; thirteen thoracic; six lumbar; five sacral (fused into one bone), and eighteen to twenty coccygeal.

Ribs and Sternum.

There are normally thirteen pairs of ribs; eight pairs of sternal, and five pairs asternal.

The sternum consists of seven sternebrae; the cariniform cartilage being absent.

The thorax is relatively short and wide.

Cranium and Face.

The occipital is very strong and thick.

The sphenoid is very short.

The ethmoid rather extensive.

The interparietals small.

The parietals form part of the temporal fossae.

The frontals form nearly one-half the length of the skull.

The temporals, divided into the squamous and petrous parts, which fuse at birth, form protective coverings for the auditory canal.

The maxilla is short and broad.

The premaxilla is thin and flattened.

The palatine bone is relatively large.

The pterygoid bone is comparatively large.

The nasal bones are short, the size depending on the breed.

The lacrimal bone is large.

The malar bone is relatively large.

The turbinals are very fragile.

The vomer is wide, its size depending on the breed.

The mandible or inferior maxilla does not completely fuse during life.

The hyoid is very short.

The facial sinuses are very important, and are as follows:

Frontal, divided into three portions, just below and around the orbital cavity.

Maxillary, bounded by the maxillary and lacrimal bones. The facial tuberosity may be used as the external landmark.

The palatine is found just above the roots of the molar teeth.

The ethmoid is found beneath the frontal sinus, a little above and anterior to the ethmoid bone.

The frontal sinus is the resting place for "grub in the head."

The skull, as a whole, is very powerful and well protects the head. The sheep's chief weapon of defense is butting, and its head has been developed to withstand extraordinary concussion.

Thoracic or Front Limb.

The bones of the front limb are small but powerful, and consist of the following:

The scapula is nearly triangular in shape.

The humerus is short, and has a very small deltoid tuberosity.

The radius is short and relatively broad.

The ulna extends nearly the whole length of the radius.

The carpus consists of six bones, four in the upper row and two in the lower.

The metacarpus consists of the large metacarpal and a small metacarpal.

The digits are four in number, only two are fully developed. They have three phalanges and three sesamoids each.

Pelvic Limb.

The ilia are almost parallel.

The ischium is relatively large. The acetabulum is very small, and the pelvic inlet is rather elliptical and oblique.

The femur is comparatively small and cylindrical.

The tibia is short and curved.

The fibula consists of the two extremities connected by a structure resembling a cord.

The patella is rather long and narrow.

The tarsus consists of five bones, several being fused together.

The large metatarsus is longer than the corresponding metacarpus; the small metatarsus being a quadrilateral disc.

The phalanges and sesamoids are almost identical with those of the front limb.

Joints and Ligaments.

The temporo-mandibular articulations permit of the extensive lateral movements of rumination.

The ligamentum nuchae is well developed.

The articulations of the thorax are immovable.

The shoulder joint has an acute articular angle.

In the elbow joint no movement occurs between the radius and ulna.

The carpal joints are very free.

The metacarpo-phalangeal joints are two for each digit.

The sacro-iliac joint is very strong.

The hip joint is well protected by a marginal cartilage which reinforces the shallow acetabulum.

In the stifle joint the synovial sacs communicate so freely as to form a common joint cavity.

The tibio-fibular joint is a complete arthrosis.

The hock joint has very little mobility.

Adapted as the sheep is for mountain climbing, its joints are very strong, and dislocations are rare.

The Muscular System.

The panniculus is well developed.

The masseter is not large but is well developed.

The hyoid muscles are very strong.

The diaphragm is appreciably more oblique than in the ox, and relatively wide.

The muscles of the shoulder girdle, shoulder, arm, forearm, abdomen, pelvis and pelvic limb are similar to those of other animals.

There are four extensors of the leg and foot.

Sprains of muscles, even on the roughest of ground, with much jumping, rarely occur in sheep.

The Digestive System.

The lips are thin, and the upper one is marked by a distinct cleft.

The hard palate is smooth, and the mucous membrane more or less pigmented.

The cheeks are lined with large papillae.

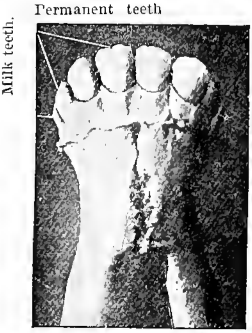
The tongue has a smooth tip.

The milk teeth number twenty.

There are thirty-two permanent teeth: eight incisors in the lower jaw; none in the upper; six molars in each arcade, or twelve in the lower and twelve in the upper jaw. The cement is usually black. The following table gives the eruption periods of the various teeth:

Teeth	Temporary	Permanent
Central incisors	At birth	1 year
Second "	1st or 2d week	2 "
Third "	2d or 3d "	3 "
Corner "	3d or 4th "	4 "
First molar	4th week	1½ to 2 years
Second "	"	" " " "
Third "	"	" " " "
Fourth "		3 to 5 months
Fifth "		9 to 12 "
Sixth "		1 to 2 years

When the lamb is about a year old, the central pair of milk teeth drop out, and are succeeded by a pair of permanent teeth.



Dentition of 2.5 to 3-Year Old Sheep.

When about two years of age, the second pair of milk teeth (on each side of the centrals) drop out, and permanent teeth appear in their place.

A year later, the third pair of milk teeth are "shed" and permanent teeth appear in their place.

At about four years of age, all the milk teeth have vanished and the sheep has a "full mouth."

Forced feeding and fattening cause the teeth to drop out earlier; some show sheep having lost several of their permanent teeth before the age of five years. However, as a rule, the seven-year-old has lost one or two, and has a "broken mouth"; but one cannot tell the age of sheep with certainty, by the teeth.

The salivary glands are well formed and the parotid ducts open opposite the third molar.

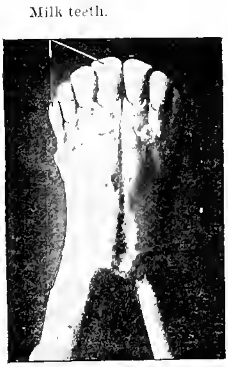
The tonsil is bean-shaped and about one-half inch long.

The pharynx has a median fold which is a continuation of the nasal septum.

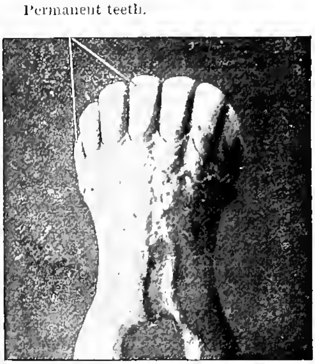
The esophagus has a lumen of about one inch when moderately distended.

The four compartments of the stomach—the rumen, reticulum, omasum and abomasum—have a total capacity of about four gallons. The omasum is very small, having a capacity of only a pint. The abomasum is larger, holding nearly two quarts.

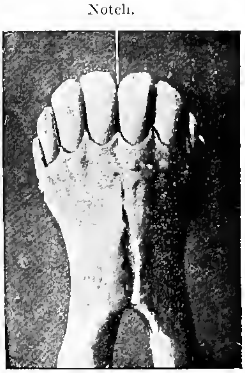
The small intestines are about eighty feet long, and the lumen is about one inch in diameter.



Dentition of Yearling Sheep.



Dentition of a 4-Year Old Sheep.



Dentition of a 6-Year Old Sheep.

The cecum is about a foot long, and of a capacity of nearly a quart.

The colon is about fifteen feet long, its lumen ranging from one inch to two inches.

The liver weighs about one and one-half pounds, and lies mainly on the right of the median line.

The bile duct joins the pancreatic duct and opens into the duodenum about a foot posterior to the stomach.

The spleen is triangular in shape, weighing about three ounces.

The Respiratory System.

The nostrils are small and not very dilatable.

The nasal cavity is very short and narrow behind.

The larynx is small and compact.

The trachea is small, and anyone who has attempted to inject gasoline into it will concur in the statement that it is very mobile.

The thoracic cavity is small, and the pleura thick.

The lungs are very unequal in size, the right one being the larger. The left one has three lobes, and the right has four or five.

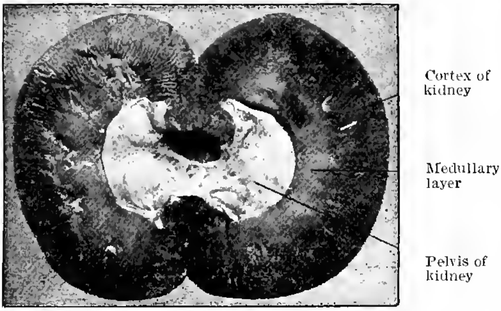
The thyroid is very extensive, being largely utilized in the manufacture of a biological product.

The thymus is very pale and delicate.

The Urinary Organs.

The kidneys weigh about four ounces, and are bean-shaped. The right kidney lies under the first three lumbar vertebrae, while the left one is usually further forward. In the adult sheep, when the rumen becomes distended with food, the left kidney is pushed back several inches.

The ureter of the left kidney has a peculiar course, due to the movable position of the kidney. It curves upward and inward, and crossing the median plane, runs backward on the left side. The right ureter runs back in a relatively straight line.



Sectioned Sheep Kidney.

The bladder is long and narrow, and extends rather far forward on the abdominal floor.

The adrenals are bean-shaped. The right one lies along the inner border of the kidney and is about an inch long and wide. The left one is somewhat longer and slightly bent in shape. It lies across the left renal vein, and is not in contact with the kidney.

The Male Genital Organs.

The scrotum is long, pendulous and has a distinct neck.

The testicles are very large and oval.

The epididymis is very adherent to the testicle.

The spermatic cord is long, and the vaginal ring small.

The vas deferens is of small caliber.

The vesiculae seminales are compact.

The prostate is light yellow in color.

The penis is cylindrical, with a urethral process extending out from the glans.

The prepuce is long and narrow.

The urethra lies in a groove on the lower surface of the penis, forming a twisted process. Its diameter is not over one-sixteenth of an inch. This is one reason why mangels or sugar beets are a dangerous food for rams and wethers, on account of the calculi they form.

The Female Genital Organs.

The ovaries are small.

The fallopian tubes are long and tortuous.

The uterus lies almost entirely in the abdominal cavity, a thing that should be remembered in diagnosing pregnancy.

The vagina is short, with a thick wall.

The urethra is short, and dilatable. This prevents serious consequences from urinary calculi in ewes.

The mammary glands are relatively large, and pigmented.

The Circulatory System.

The average sheep has about one gallon of blood; lambs scarcely a pint. This makes it an easy prey to blood-sucking parasites.

The pericardium is usually buried in a mass of fat.

The heart is relatively large and situated principally upon the left of the median plane, being opposite the third to the fifth ribs.

The arterial and venous systems are similar to those of other animals.

The lymph system is very well marked in the sheep.

The Nervous System.

The diseases of the nervous system are many and varied in the sheep, but as practically all pathological lesions are caused by parasites, not much can be done, except to perform a very careful autopsy.

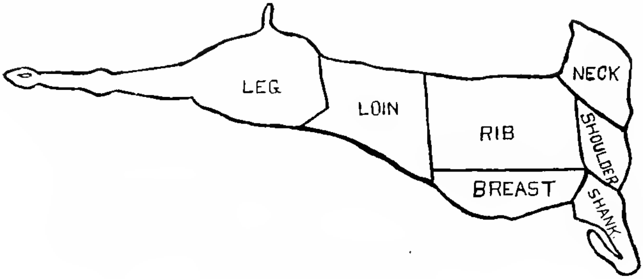
The spinal cord is long and small, and the brain is relatively small. The nervous system is similar to that of other animals; perhaps not so highly developed as in the horse and dog.

The Organs of the Special Senses.

The eye is round, and the lids rather thick. The vitreous body is not very fluid.

The ear inclines outward and upward, differing in the several breeds. The auditory canal is small.

The skin is thin and of a pinkish hue when the animal is in good health, and covered with wool. The caliber of the wool fiber varies from one five-thousandth of an inch in Merinos to one four-hundred-fiftieth of an inch in Cotswolds.



Cuts of Mutton.

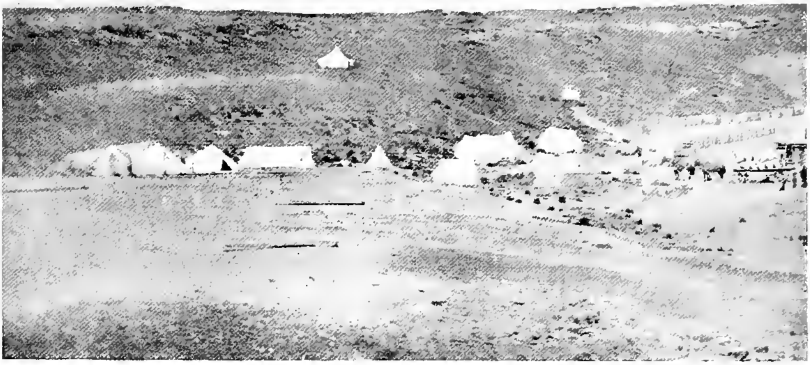
The olfactory organs are well developed; the ewe depends upon the sense of smell to identify her young.

The sense of taste is highly developed; no animal has a more dainty taste than has the sheep, still it will eat poisonous plants, such as death camas, when it is young and succulent, and the animal is very hungry for green food.

CHAPTER IV.

HYGIENE.

All of those methods by which sheep are shielded to a greater or less extent from disease, kept in a state of health, and which contribute to their thrift, may correctly be classed as hygiene or sanitation.



Typical Shearing Pens.

No animal has less resistance to disease when once infected than has the sheep. No animal repays hygienic care and surroundings with greater profit than this one.

For detailed information as to the management of sheep, the reader is referred to various books devoted to this subject. The following discussion is designed merely to outline the management and care that is conducive to health.

General Care.

The care of fifty sheep on a small eastern farm is a vastly different undertaking from watching over a band of many thousand on the western range. While the habits of the animal are the same, whether in a bunch of a dozen or a band of three thousand, the management must vary to meet existing conditions. For that reason, the carefully formulated rules that may suit one breeder's fancy will be utterly out of place or wholly impractical for another.

In all cases, however, kindness, cleanliness, liberal and regular feeding, together with a natural aptitude for caring for sheep are essentials for success.

In the Range Country.

The pulse rate of sheep varies considerably, although seventy to ninety beats a minute may be taken as an average. Respirations vary from twelve to twenty a minute when the animal is perfectly at ease. The temperature is usually around 103 degrees Fahrenheit, taken per rectum, although this depends to some extent on the age, weather, and degree of fatness.

No other animal so clearly exhibits the symptoms of disease as does the sheep. The loss of appetite; the listless air; the dull eye; the drawn-up appearance of the abdomen, and the seeking of a lonely spot in which to lie down, clearly point out the existence of some disorder. Other symptoms, more or less marked, give a clue to the actual trouble, although in many cases where there is no history to guide one, the diagnosis must be made largely by exclusion, or from a postmortem examination of some animal similarly affected.

Digestion in the Sheep.

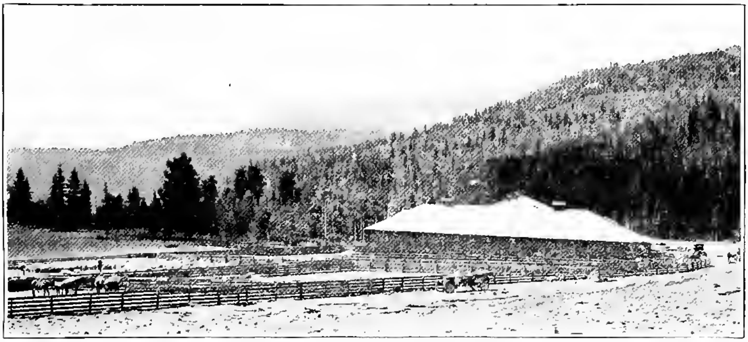
Very little attention or investigation has heretofore been devoted to the study of digestion in the sheep, and the following clear and concise description as given by Professor Hayden, of Cornell, will be found particularly helpful:

Sheep Barn at University of Idaho—A Convenient Type of Barn for a Small Farm Flock.

"The sheep is essentially a ruminant. Its mechanism of prehension, mastication, deglutition, rumination, and digestion is with slight variations that of any other ruminant. It shows much the same limitations in the exercise of the digestive function as do other animals of its type.

"By force of circumstances a sheep may be omnivorous in its diet. It has been called the scavenger of the farm. The term "Golden Hoof" is just as aptly applied. It is called scavenger because it will, under duress, eat almost anything. It will eat anything from frozen meat, fish or the offal therefrom. It is called the "Golden Hoof", because in addition to eating anything that is eatable it furnishes a manure that is extremely rich in fertilizing value and spreads that fertilizer most evenly and uniformly on the land over which it grazes. Its thorough mastication and digestion of weed seed aid greatly in eradicating weeds from the land. The term "Golden Hoof" is more applicable than that of scavenger. The carnivorous part of a sheep's appetite is not natural. It eats of frozen flesh only because the herbage has been buried so deeply under snow and ice that it cannot possibly get to it even with its unlimited patience.

"Being a so-called scavenger, it may be used to clear land almost as completely as does the goat. These habits of economical grazing do not mean that it should be made to pasture upon the same land continuously nor that it should be made to subsist upon pasturage alone. The digestive tract cannot provide a profitable food supply to the tissues from pasture alone. Such a diet will provide for maintenance and leave too little for production.



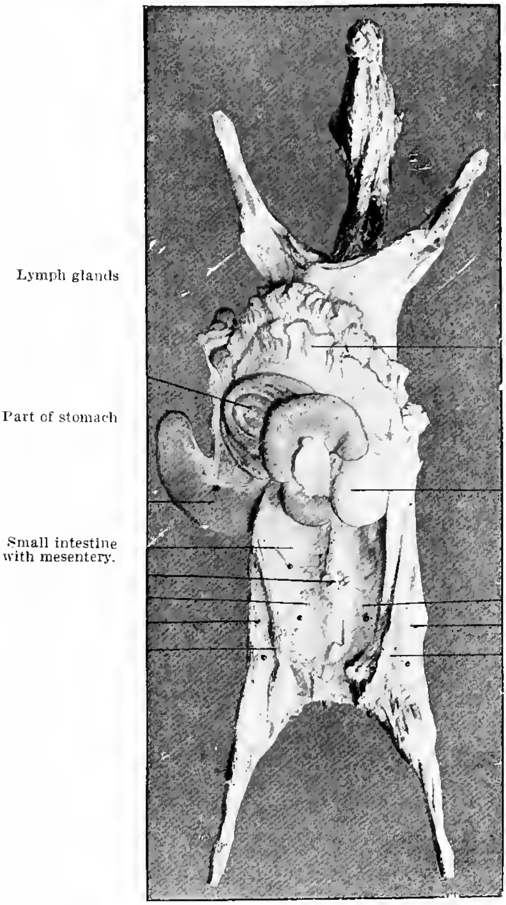
AUSTRALIAN SHEEP-SHEARING SHED, SHOWING CORRALS.

"The digestive system of the sheep will handle nine-tenths of the weeds growing on the farm. The rations that are added to the diet should be varied according to seasonal conditions and requirements. When pasturage is abundant less food need be supplied. The diet of both male and female should be regulated in order to insure the best in the way of lambs. The shepherd who allows his sheep to live wholly on forage will find his flock running down and as surely becoming unprofitable.

"Of the food that man prepares and stores up the sheep digests well most all of the concentrates. Corn and oats are well taken care of. Of the succulent foods good sweet corn ensilage and rutabagas are well digested. Such hays as alfalfa and clover are most desirable. Timothy hay is objectionable in that it causes constipation and the barbs work down into the wool lessening its value and causing irritation to the skin. The male should not be fed mangels or sugar beets. Either of these roots are said to lead in some manner to the formation of urethral calculi with a consequent retention of urine and uremia as a sequela. Such effects are not noticed in the female.

SOMETIMES THE WHOLE FAMILY GO WITH THE SHEEP FOR THE SUMMER.

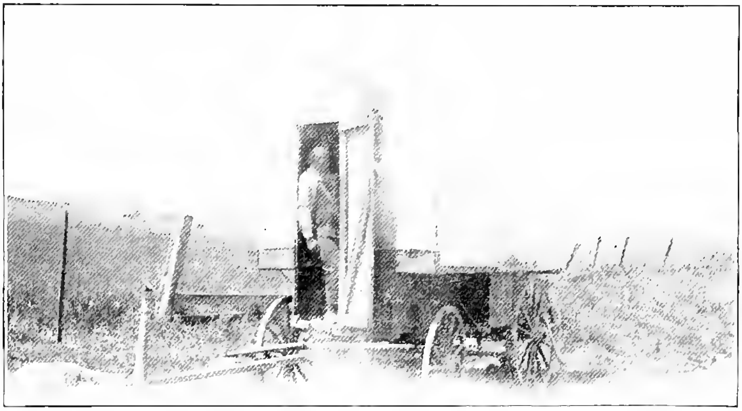
"Because it has been called the scavenger of the farm it is not to be inferred that the digestive tract of the sheep is immune to the disorders of digestion seen in other ruminants. Clover and alfalfa, influenced by bad weather conditions, lead to tympany just as they do in the cow. Frozen or frosted food causes colic or stretches. Soured or moldy silage is just as harmful as when fed to other animals. Founder results from overfeeding. Lack of exercise and a diet too rich in proteins lead to parturient paresis in the pregnant ewe. Dietetic errors are said to lead to abortion at times. Animals in the feeding lot die because of faulty diet. Death may be due to an interference with the functions of digestion or toxemias arising from a diet too heavy in proteins. The digestive tract of the sheep has no peculiar enzymes or bacterial flora that can overcome the effect of frozen or spoiled foods. They are in no sense immune to the effects of mineral and vegetable poisons.



Alimentary Canal of Sheep After Opening Abdomen.

"There is a close relationship betwen the nervous organization of the sheep and its feeding habits and digestion. Sheep that make the most of their food are those that are handled by a person who is soothing to them and shows regularity in feeding and judgment in selecting food. The harmful influence of fear, anger, variation in food and irregularity in feeding time on digestion in the sheep is even more patent than in other animals.

"Water and salt are prime essentials to proper digestion and assimilation. Water is obtained from the food or springs. Food should never be depended upon to furnish the supply. Two to six quarts per day are needed by the average sheep, and clean springs or other available means of water supply should always be at hand. Foul water supply may be the source of parasitic infestation. Salt is necessary to increase the palatability of food and in the processes of metabolism.



Ready for the Trail.

A sheep outfit, like an army, travels on its stomach. Here is shown the commissary department of a well-regulated camptender.

"The lips, teeth and tongue as organs of prehension do not need description in this article. Suffice it to say that they are well adapted to the sheep's habits of feeding. The glands of the mouth region are numerous. Their secretion has very little part in the digestion of food. The function of the secretions is largely mechanical. It softens the food and aids in its maceration. It also aids in deglutition and rumination.

"From a mechanical standpoint the rest of the digestive tract may be divided into two portions. The first three divisions of the stomach are mainly for the maceration of food. The fourth division or abomasum is the only compartment in which enzymes are produced. The intestines as the second main division of the tract are said to be principally for absorption.

"The rumen has a capacity of three gallons. It is divided into four compartments by visible muscular pillars. The mucous membrane is covered with papillae. Glands that secrete digestive enzymes are apparently lacking. The real digestive function of the rumen is then mechanical. It macerates the food so that its future digestion is made easier. To macerate the food three agents are at work. One is enzyme action from enzymes present in the food. A second is bacteria. A third, and by far the most important, is the revolving, churning and violent agitation of the food that is undoubtedly carried on by the contraction of the rumen. The contraction of both rumen and omasum is quite constant. The reticulum has more rest than these two. The contents are usually alkaline. This is due to the large volume of saliva swallowed by the animal. The great bulk of saliva is essential to the processes of maceration and rumination. The writer has found the amount of ptyalin in the saliva of the sheep to be negligible and so it probably does not digest much carbohydrate.

A BAND OF 2,200 SHEEP ENROUTE TO THE SUMMER RANGE.

"The reticulum secretes no digestive fluid. Its capacity is small. The fluid found therein is alkaline and is probably used in the process of rumination. It has been demonstrated that this compartment is not essential to the process. It may also regulate the passing of food from the first to the third compartment. The foreign bodies, such as pieces of wire and nails, that are found in the reticulum are at times the cause of traumatic pericarditis as in the cow.

"Before the food passes to the omasum, or third compartment, the process of rumination or remastication takes place. This is a complex operation in which many structures are involved. All of the parts are under very definite nerve control, and any derangement of that control leads to a disturbance of rumination. The rumen, reticulum, esophageal groove, esophagus, mouth parts, and the abdominal muscles and diaphragm are the parts most concerned. The rumen must be reasonably full and well supplied with fluid. The reticulum and esophageal groove are accessory but not essential to the formation of the mass of food that is to be remasticated. The length of time taken to handle a bolus is about one minute. The animal uses as much as seven hours a day for the operation and thus requires much rest for ruminating animals like a recumbent position for this phase of digestion. Lack of rumination is a good index in diagnosis. Fevers or digestive disturbances are apt to curtail the flow of saliva, so necessary to the process, and thus lead to disturbed rumination. In health the rumen contracts about three times a minute.

"Food is further masticated in the omasum. This compartment with its many papillated leaves forces the food from the reticulum to the abomasum. The papillae on the leaves and the successive movement of these leaves makes the omasum a triturating or masticating stomach. The food is forced against gravity and so the fluid is constantly being drained off. With illness there is a lack of fluid and the contents become dry and caked. There are no enzymes produced by the membrane of the omasum.

"The first enzymes to be produced in any quantity are secreted in the abomasum or true stomach. Pepsin acts on proteins, rennin on milk, and a possible lipase on fats. The reaction of the contents is generally acid.

"Little absorption takes place from the stomach. That is said to be the chief function of the intestines. Considerable digestion must take place in the small intestines at least. Specific enzymes are furnished from two sources with considerable aid from a third. The walls of the small intestines secrete the succus entericus. This contains several enzymes. Erepsin acts on proteins and is much stronger in its action than the other proteolytic enzymes. Enterokinase changes trypsinogen to trypsin. There are three ferments that break down complex sugars to simple ones. Sucrase acts on cane sugar, maltase on maltose, and lactase on lactose. Dextrose is an end product of the action of all of these inverting ferments. Secretin is a mechanical agent from the same source. It stimulates the flow of both the bile and pancreatic juice. The pancreas produces amylase digesting starch, lipase digesting fats, and trypsin digesting proteins. The bile is a great aid to intestinal digestion. It increases the activity of the enzymes, increases peristaltic action and is said to have some antiseptic action toward the contents of the intestines. Intestinal activity is enhanced by bacterial action. The bacteria help to break the food up into simpler particles.

"The respective enzymes tend to change proteins to peptones and amino acids, carbohydrates to simple sugars such as dextrose, and fats to fatty acids and glycerin. There is specific provision made for the absorption of these end products. The fats get into the circulation largely through the lacteals and the thoracic duct. The carbohydrates pass through the portal vein and the liver and the proteins partly the same way and partly through the general circulation.

"In the sheep as well as any other animal there are a large number of internal secretions and they are intimately related to the processes of digestion and metabolism. Disturbance of the thyroid gland is not uncommon in the sheep and is much dreaded by the experienced shepherd. It is a source of unthriftiness in the animal.

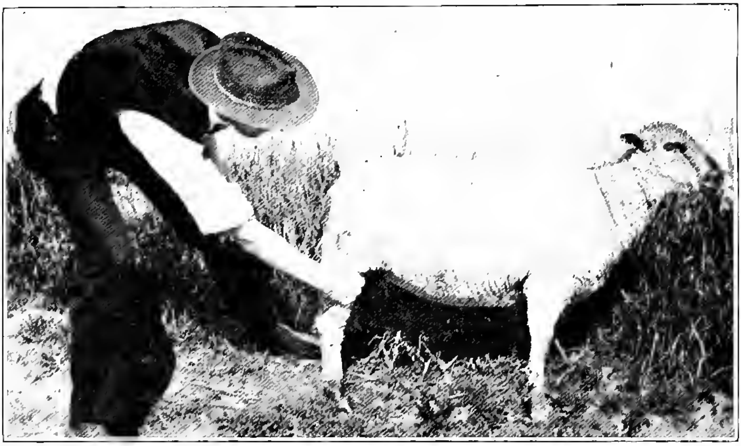
"Digestion in the sheep is not a simple process. A large amount of low profit from this animal is due to the disturbances in the physiology of the process. The mechanism is much the same as that of the cow. The disturbances in digestion are due to much the same causes. It follows then that the same care should be used in selecting food for and feeding the sheep as for the cow."

Handling.

Catching a sheep for examination is often performed incorrectly or carelessly. Grabbing a sheep by the wool often causes a bruise that may persist for months. Nothing else makes quite so unfavorable an impression upon the experienced sheep man as lunging wildly at an animal, and going through unnecessary antics in attempting to catch it.

As strangers frighten sheep, it is better to have the one accustomed to taking care of the flock catch the animal desired. If this is not possible, drive the sheep into a small enclosure and grasp the flank, just over the stifle.

To set it on its rump, place the left arm around the sheep's neck and hold the right forearm of the animal with the left hand. With the right hand reach under and grasp the right hind leg above the hock. Pulling it against one's breast and exerting a little traction on the hind legs, the sheep will be raised on its rump easily, and rendered powerless to struggle.

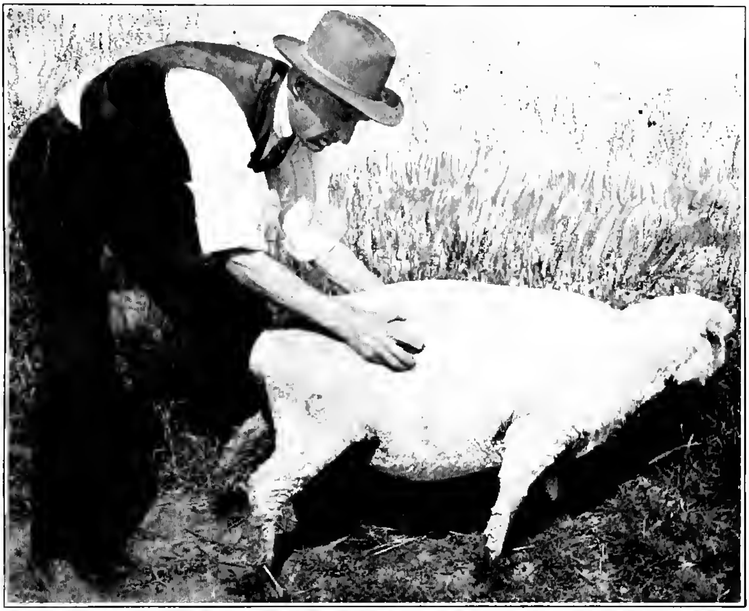


AN EASY AND CONVENIENT METHOD OF HOLDING A SHEEP WITHOUT EXCITING IT.

Leading a sheep is a simple matter when done correctly, although some Merinos will be found to be more stubborn than a mule. Get on its left side, place the left arm around its neck, with the other hand on its tail-head, and by tickling it slightly, the animal will walk briskly along.

To carry a sheep, if it be a small one or lamb, stand at the rear and to the right, slip the right hand back of the sheep's right front leg and place it between the front legs. Lift it up slightly in front, and grasp the left hind leg just above the hock. Lift up, catching hold of both hind legs. This renders the sheep helpless, and it can be carried without struggling.

To load sheep into a wagon without a chute, two men can handle a small bunch quickly in the following manner: One man stands on each side of the sheep. The right hand of one grasps the left hand of the other between the forelegs, and the other hands are clasped in a similar manner under the flanks. Chutes are used where there are large numbers, and a goat acting as leader saves much time.



INCORRECT MANNER OF HOLDING SHEEP.

Attempts to hold sheep by grasping the wool result not only in extensive skin bruises, but cause more effort on the part of the animal to get away.

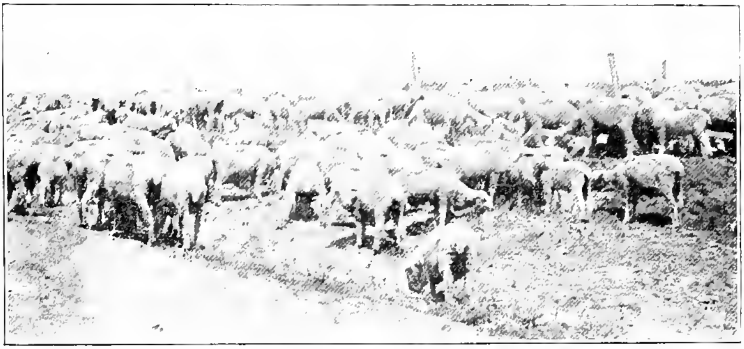
Shipping sheep singly in crates supplied with a gunny sack of hay and grain is accomplished with very little loss. The expressmen, as a rule, take good care to water the animal at frequent intervals.

Feeding.

As this is not a text on sheep management we merely wish to emphasize the importance of punctual feeding from the standpoint of hygiene.

On the western range, alfalfa, field peas and kale are largely used as winter feeds. Pregnant ewes are given a small quantity of oats towards lambing time. Alsike, clover, rape, rye, roots, and many other foods are used, depending on the locality and cost of feed. Timothy is very constipating, leading to "blind staggers," following impaction. Those sections supplied with "bunch-grass" and where the snow is not deep, are fortunate, for nothing else is needed, except sulphur and salt.

In the East, and for fitting sheep for exhibition, silage, cabbage and concentrated foods of many kinds are used.



To the Summer Range.

Leaving the home ranch in May or June, the band of 2,000 or 3,000 sheep and lambs slowly trails to the forest reserve.

Orphan Lambs.

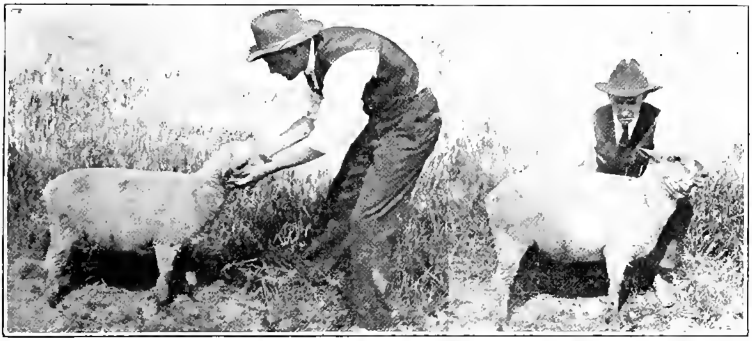
Many lambs that have lost their mothers may be saved by a little patience and proper handling. In case the little orphan is almost lifeless when found, it may be dipped into lukewarm water, and warmer water slowly added. It may then be dried, and rolled in flannel. In case a stimulant seems necessary, a half teaspoonful aromatic spirits of ammonia may be mixed with a little warm water, and carefully poured on the tongue. Should expert assistance be available, a hypodermic injection of five cubic centimeters or less of sterile ethereal camphorated oil may be administered.

As soon as the lamb revives, it may be given some milk, taken either from a ewe or a cow. It soon learns to feed from a nipple, and in a few days will be munching grass or hay.

The greatest trouble in rearing these orphans is too frequent feeding, and the lamb succumbs from too much care and food, with resultant diarrhea.

Control of Sex.

Many experiments have been made to determine methods of sex control. The results have shown that young rams, from one to two years of age, produce the most ewe lambs, over sixty per cent, while aged rams, from four to five years old, produce the most buck lambs. The age of the ewe seems to make little difference.



On the left is shown an incorrect method of leading sheep. The sheep is naturally stubborn and resents "pulling." On the right is shown the correct method of restraining a sheep. With this method the sheep is perfectly at rest, but is powerless to get away.

Fever.

This is merely a symptom of various disorders, ranging from simple excitement, heat, or obesity, to infectious disease. It should be regarded as a weapon of nature to overcome bacterial invasion, and antipyretics should be used very sparingly. Often, a very high fever at the onset of a disease cuts short its course; while one beginning with a rather normal temperature will prove fatal.

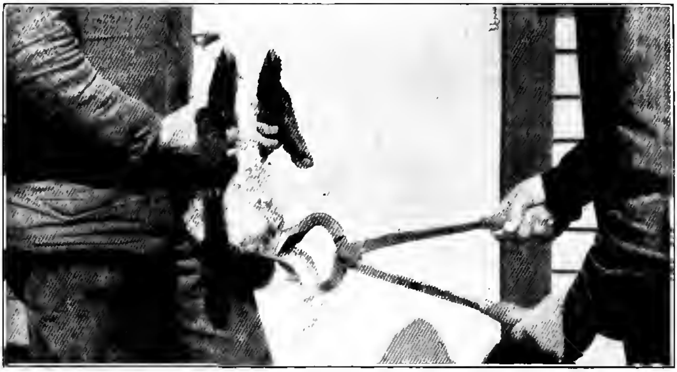
Fly Repellents.

Everyone is familiar with the annoyance caused by flies, and the flockmaster who does not protect his sheep from these vicious little pests will lose much in thrift and production of wool.

The "grub" or "sheep bot fly" is particularly busy during July, August and early September in our northern latitudes. For the prevention of these, numerous schemes have been devised, but none have been so successful as providing shelter to run into during the heat of the day. For the small band, a shed can be made dark and protective by hanging curtains of gunny sacks over the doors and windows, and hanging sheets of this material from the ceiling, containing coal tar dips.

To Destroy Sheep.

When a sheep has been injured by dogs or predatory animals beyond hope of recovery, or an autopsy is desired for diagnosis, the most humane method is to cut the throat and break the cervical vertebrae by bending the head back.



Courtesy American Sheep Breeder

HOW A LAMB IS DOCKED WITH HOT PINCHERS.

Due to the exceedingly thick skull it is very difficult to kill a sheep by knocking it in the head or even by shooting it.

A sharp pointed "sticking knife" should be used. Introduce it inside the jugular furrow, and with one quick incision, cut from within toward the skin, severing all the vessels. Then bend the head back as far as possible, and death ensues in a very short time.

In case of suspected infectious disease, the blood should be drained on straw, so that it may be burned or rendered harmless by antiseptics.

Shepherd's Calendar.

March: The lambing season. This depends greatly upon the locality and breed.

April: When about two weeks old the lambs are docked, branded, and the males castrated. The feet of the whole band should be attended to.

May: The sheep are sheared and dipped and started for their summer range.

June, July and August: Feeding in the forest ranges, often in sight of snow-capped mountains. This is one reason why western sheep are so healthy and thrifty; they are far above the parasite-infested lowlands. The lambs are weaned when about four to five months old. Wether lambs sold.

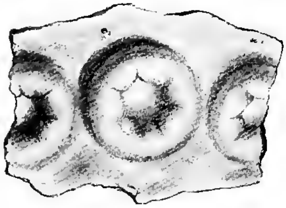
September: Toward the latter part of this month, the band is slowly trailed back home. In the Northwest, fields of wheat and oats "stubble" are purchased to turn the sheep into. In Colorado field peas are used.

October: The band is culled, and the bucks turned in. Toward the latter part of the month the feet are again trimmed if necessary.

November, December, January and February: Feeding at the home ranch, and selling lambs when the prices are favorable.

Care of the Ewe.

The period of estrum continues from two to four days, and the ewe will come in heat again in about sixteen days if not pregnant.



Uterine Cotyledons of the Ewe.

The average period of gestation is about one hundred and forty-five days, or four and one-half months. Male lambs are carried a little longer. If a ewe goes over a week after her time, the chances are the lamb is dead. Before lambing, the ewes should be "tagged" by removing any filthy locks of wool.

Separating the pregnant ewes for the winter season is the best system, for then the danger of abortion from crowding and bruising is lessened. Only the brightest and cleanest of food should be fed to pregnant ewes.

Turnips and cabbage make a good green food ration, while mangels and sugar beets are not recommended before lambing. In parts of the west, along the coast, where green food grows the year around, these problems are solved by nature. Before lambing the food should be abundant and laxative, a pound of equal parts of bran and oats being a fine addition to the hay ration.

When the weather is not too stormy or wet, the animals should have plenty of exercise. This will prevent many cases of difficult parturition. The old English method of hauling a load of hay a mile from the sheep corral, compelling the sheep to follow it for their food, and then driving them back in the evening, was an excellent one.

In the early spring, after a hard snowy winter, when the band is turned out to pick over the rough parts of the ranch, many abortions and deaths occur among the ewes from eating brush, moss, or any green forage that may be full of turpentine or other toxic ingredients. Frozen roots, spoiled silage, moldy hay, and an exclusive diet of timothy have caused the death of many a pregnant ewe.

When the lambing season arrives, the busiest time of the year on a sheep ranch is at hand. The ewes expected to lamb early should be given a roomy pen, dry, clean and quiet. As ewes seldom lamb between midnight and early in the morning, one should watch them at all hours, except this time.

When a lamb gets away from its mother and she later refuses to claim it, they should be put in a pen together. If the mother butts it away, she should be tied up and the lamb allowed to suck. This usually causes a family reunion.

The various diseases and disorders of the ewe are considered in the section, "Diseases of the Ewe."

Care of the Lamb.

If the lamb is born normal, and does not become infested with parasites, very little need be done to keep it in a healthy and thrifty condition.

When an apparently "lifeless lamb" is dropped it may be possible to resuscitate it by the following method: Clean all mucus from the mouth and nostrils, and blow gently into the nose. Lay it on its belly and slightly tap each side over the lungs. A whiff or two of aromatic spirits of ammonia is beneficial.

For a chilled lamb, wrapping it up in a warm coat or blanket and giving a few drops of aromatic spirits of ammonia. Spirits of camphor and sweet spirit of nitre both contain large amounts of alcohol, and may be employed as stimulants.

When a lamb must be raised by hand, remember ewe's milk is much richer in fat and somewhat richer in casein than cow's milk, as the following table will show:

Lambs at Shearing Time Cut Away From Ewes.

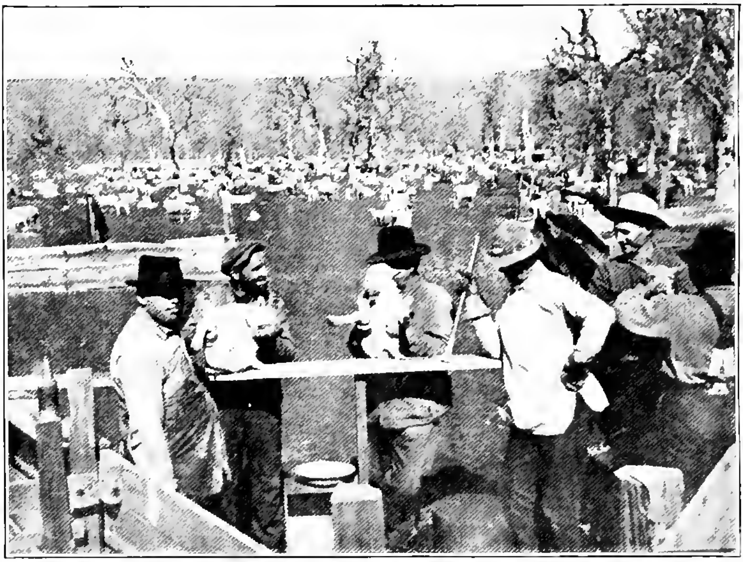
MILK ANALYSIS.

	Ewe	Cow
Water	80.82	87.27
Casein	4.97	3.02
Albumin	1.55	0.53
Fat	6.86	3.69
Sugar	4.91	4.88
Ash	0.89	0.71
	100.00	100.00

The specific gravity of ewe's milk is about 1.0341. No water should be added to cow's milk to feed an orphan lamb, but rather the richest whole milk that can be obtained. If the ewes have been fed oil cake the milk is increased greatly in fats, often causing scours in the lambs.

When the lambs are about two weeks old, on a bright, sunny day, the males should be castrated. Select a clean, dry place for this work, and with disinfected hands and knife, hold the lamb, and cut off the lower third of the scrotum. Pull the testicle and entire cord out. In older lambs the cord may be scraped off. If everything is kept clean no further attention is required. Keep the lambs by themselves for several hours as they will lie down and get trampled if put in with the rest of the sheep. Castrating in the evening has proved very successful with some breeders, as it gives the lambs a chance to remain quiet over night.

At the same time the males are castrated, all the lambs may be docked, branded, tattooed and marked. The easiest and most bloodless method of docking is to heat a pair of pincers red hot and use them to sever the tails; over a dozen lambs can be docked with one heating.



Docking in a Band of 12,000 Sheep and Lambs.

When the lambs are about four or five months old, or along in August, they are weaned. By this time they have learned to pick up almost enough feed to satisfy their wants, and merely taking them entirely away from the ewes, a day or two, will wean them.

At weaning time it is a good plan to separate the ram lambs from the others, although this is not done sometimes until they are six months of age.

A healthy lamb will become plump and make a steady growth. A stunted lamb seldom "catches up." It is remarkable how fast range lambs fatten in the fall while trailed back on stubble or field peas. Many a carload has topped the market from just this kind of feed.

Care of the Buck.

If the animal has been kept in good condition and given sufficient exercise, he requires little attention. A ration of bran and oats fed a month or so before the mating season is conducive to vigor. Sugar beets and mangels should never be fed bucks or wethers, for, as stated elsewhere, urinary calculi are apt to be formed, which, owing to the small caliber of the urethra—one-sixteenth of an inch—leads to death.

On the western range about one buck to every thirty-five ewes is the usual number.

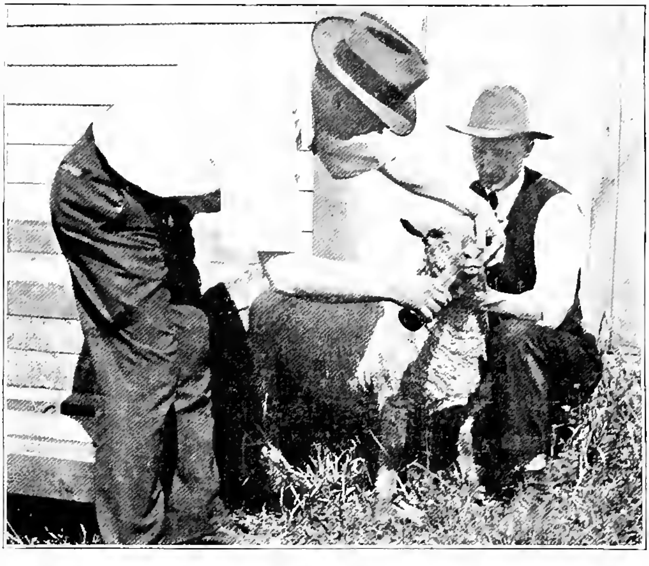
After the mating season the male should be given sufficient food to keep him in fair condition, but not fat. Exercise is the most essential thing in sheep hygiene. They are naturally roving animals, and the main cause of impotent bucks is traceable to lack of exercise which leads to vicious habits and excessive fat.

CHAPTER V.

MEDICINES AND THEIR ADMINISTRATION.

General Consideration.

Comparatively few medicines are used internally in the treatment of sheep diseases. Due to the tortuous digestive system, drugs are very slowly absorbed and usually the animal is dead before action can be obtained.



Drenching a Sheep.

Gently rubbing the roof of the mouth with the fingers of the left hand, and giving the medicine very slowly, with the head up just far enough to prevent the liquid flowing out of the mouth, avoids any possibility of causing mechanical pneumonia.

As most ailments that require medicinal treatment are emergency cases, such as poisons, parasites and injuries, large and heroic doses must be given, and repeated often.

It is well to remember the common remedies found in every household or sheep camp, such as salt, pepper, ginger, soda, turpentine and the like, for often one does not have access to a complete medicine chest. To be able to use what is at hand intelligently is better than to know the pharmacopeia by heart and overlook the simple remedies. Long treatises have been written on drugs, but the more experience one has in the treatment of sheep, the fewer drugs he will use. To not overdo the treatment requires as much judgment as to render adequate aid.

As many sheep are herded during the summer season far up in the mountains away from the haunts of civilization, and where veterinary attendance is not available except in extraordinary cases, veterinarians can serve their clients best under these conditions by outfitting a small medicine case of simple remedies and giving the herder explicit directions how to use them and also the conditions that may arise that will justify him in sending fifty, seventy-five or maybe even two hundred or three hundred miles for the veterinarian's services.

Part of the instruction given below can be adapted by the veterinarian to the use of the shepherd and given to him with such remedies as he deems necessary to be taken along to the camp when the herd is driven away for the summer.

Administering Medicines.

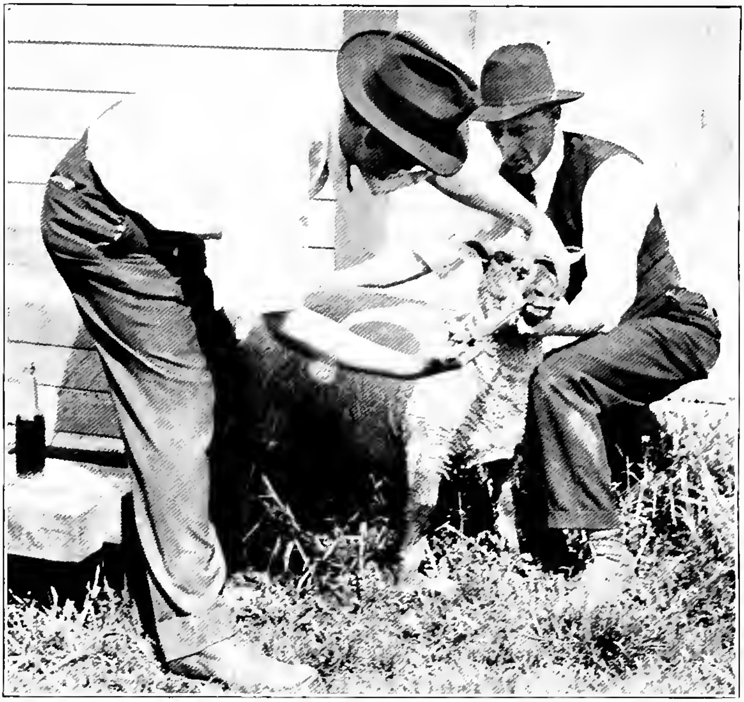
The restraint of sheep has been dealt with in the section on Hygiene.

Setting the sheep on its rump to drench it is inadvisable. Standing it in a corner is the best method to pursue, for then the danger of pouring a portion of the drench into the lungs will be lessened.

A two-ounce dose syringe is the handiest article with which to give medicine. Dilute the drugs well with water, raw oil, milk, sirup, or gruel, and introduce the nozzle between the lips in the interdental space. Do not hold the tongue, but keep the mouth closed, and the animal will swallow slowly. Proper restraint is half the battle.

To drench with a bottle requires patience and skill; unnumbered sheep have been given mechanical pneumonia by this method. Small sheep or lambs may be straddled, while large ones should be backed into a corner where they cannot run away. The left hand should be placed on the lower jaw, with the thumb in the interdental space. Place the neck of the bottle on the tongue or near it, and pour in, very slowly, about half the contents of the bottle. Rest a minute or two between "drinks."

When a bottle is not available, a spoon may be used. Pouch out the lower lip and pour the medicine into the cavity so formed.



Giving Medicine with a Syringe.

A one- or two-ounce syringe is a very convenient instrument for administering medicine. The end of the syringe is placed on the back of the tongue, and the liquid very slowly given. The fingers of the left hand may press against the roof of the mouth.

Mixing the medicines in thick sirup and smearing on the tongue or teeth in the form of an electuary is a convenient method.

Hypodermic medication may be performed in any part of the skin where the latter is denuded of wool.

Enemas are valuable in many cases. Adding a tablespoonful of glycerin to a pint of warm, soapy water adds to the efficiency of the injection.

Dips should be kept warm, and the animals treated only on bright sunny days. For foot troubles, the solution may be placed in a trough or shallow vat, several inches deep, and the band driven through it.

Dosage.

The relative dose of medicine given to a sheep is about one-fourth to one-sixth as much as given to a horse, and about four times the dose indicated for a human. The dose, however, varies greatly with the circumstances, drugs being often indicated in very large quantities; e. g., antidotes for poisoning, well diluted with water or oil.

It is well to remember that a teaspoon holds one dram, or one-fourth of a tablespoonful.

A tablespoon is nearly equivalent to one-half ounce.

A common tumbler contains about eight ounces, or one-half pint.

A common tea-cup will hold about eight ounces; although most cups carried in sheep camps hold nearly a pint, as they are more for service than for style.

Depending on the age of the lamb, from one-third to one-half the size of the dose given sheep can be administered.

A Table of Frequently Used Drugs.

No complete table of drugs used in sheep practice can be given, because there are no two localities with exactly the same disorders. The veterinarian will soon become familiar with the ailments in his immediate vicinity and use the drugs indicated.

The following table is an outline of the drugs generally used, and the safe, but active dosage appended:

Drug	Dose for Sheep
Acaciae mucilago	q. s.
Acetanilidum	ʒi
Aconiti, tinctura	m. xx
Alcohol	q. s.
Alumini sulphas	gr. xx
Atropinae sulphas	gr. 1/20
Antimonii et potassii tartras	gr. v

Drug	Dose for Sheep
Balsamum Peruvianum	q. s.
Barium chloridi	gr. v
Belladonnae rad. flext	m. xx
Bismuthum subnitras	gr. xx
Boricum, acidum	q. s.
Calcidin	gr. v
Camphorata, oleum	q. s.
Camphorae, spiritus	℥ss
Cannabis Ind. flext	ʒss
Chloral	ʒii
Carbo ligni	q. s.
Creosotum, beechwood	m. ii
Cupri sulphas	q. s.
Digitalis, flext	m. v
Dioscorea, flext	ʒii
Ergotae, flext	ʒi
Ether	q. s.
Eucalypti, oleum	ʒss
Formaldehydi, liq	ʒi
Ferri chloridi, tinctura	q. s.
Gentianae, flext	ʒss
Glycerinum	q. s.
Gasolin	q. s.
Hydrargyri chloridum mite	ʒss
Hydrogenii dioxidi aqua	q. s.
Iodi, tinctura	q. s.
Lini, oleum	℥viii
Magnesii sulphas	℥vi
Nitrosi, spiritus etheris	℥ss
Nucis vom. flext	m. x
Olivae, oleum	q. s.
Opii tinctura	ʒi
Phytolaccae, flext	ʒi
Piperitae Menthae oleum	m. x
Potassi permanganas	gr. xx
Plumbi acetas	q. s.
Potassii iodi	gr. xx
Potassii arsenitis, liq	m. xx
Petrolatum	q. s.
Potassii bichromatum	gr. i

Drug	Dose for Sheep
Rhamni Purshianae flext	ʒi
Rhei, tinctura aromatica	ʒi
Ricini, oleum	℥iv
Santoninum	ʒi
Saponis, lin	q. s.
Sodium chloridi	q. s.
Sodium hyposulphite	℥ss
Sodium bicarbonas	q. s.
Spiritus vini gallici	℥ss
Sulphur subliatum	q. s.
Terebinthinae oleum	℥ss
Zinci sulphas	q. s.
Zingerberis, tinctura	ʒi

Of the drugs mentioned above, perhaps a dozen are commonly used. Due to the delicate taste of the sheep few can be given on the feed. Nearly all must be given as a drench or an electuary.

Preventive medication, such as dipping or removing animals from parasite—or poison—infested ranges, is far more successful and satisfactory than constant drugging.

Some Valuable Therapeutic Agents.

While nearly everyone has his "pet" remedies, lack of experimentation has caused the non-use of many excellent drugs, in ovine practice. With a greater variety of therapeutic agents at his command, given in a number of different ways, from the simple drench to the hypodermic administration, the usefulness of the veterinarian will be greatly widened. With the advent of biologics, and their wonderful efficacy, the control of sheep diseases will progress more and more.

The following drugs have been used in actual practice by the author, and found to "deliver the goods." To the clinician, this is the highest test of efficacy, and it gives him confidence in his chosen line of medication. These are just a few of the medicines used in routine ovine practice, and others, just as valuable, are no doubt being used every day.

Potassii dichromas will be found to exert a beneficial alterative action, and its inexpensiveness recommends it where many animals are to be treated. Whether it operates directly on the corpuscles and stimulates leucocytosis, as *cupri sulphas* is supposed to do, is unknown. It is soluble in about ten parts cold water, and two parts boiling water. The average dose is about one grain daily. It should be well diluted, and a convenient method of preparing it for administration is to mix it with one-half dram to one pint of distilled water, giving one tablespoonful daily.

Barii chloridum, combined with *antimonii et potassii tartras,* five grains of each, will be found to have a similar action on the gastro-intestinal system of sheep as in the bovine. Strychnin may be added in one-tenth grain doses, although it is not necessary, and may cause undesirable cardiac disturbances in weak animals. The *barii chloridum* is soluble in 2.5 parts water, while the *antimonii et tartras* is soluble in 15.5 parts water. Tablets of convenient dosage are now being manufactured, and one can be crushed and given in half a pint of water every two hours, until three to six have been given. This has practically supplanted *magnesii sulphas,* and can be used in advanced pregnancy, in small doses. Applying a little salt to the tongue and allowing free access to water, not too cold, will aid in the action, together with an oil enema.

Sterile ethereal camphorated oil in 5 mil dosage, containing 5 to 10 grains camphor, will be found to be one of the most valuable stimulants known. It can be administered in almost any condition, with beneficial results. The results will be more than pleasing, in cases not already moribund. It seems non-toxic, and almost any dosage can be given with safety.

Dioscorea will be found very useful as an antispasmodic and carminative. It can be combined with equal parts *spiritus menthae piperitae,* teaspoonful doses of each. It is particularly useful in the treatment of lambs and in forage poisoning; in the latter case, of course, combined with intestinal antiseptics.

Alumini sulphas, recommended so much in plant poisoning, is soluble in nine parts water. Its astringent action prevents rapid absorption of the toxic contents of the stomach, and this is its most valuable property. The usual dosage in sheep is from fifteen to sixty grains, but when one is in a hurry, exact measurements are not essential.

Potassii permanganas, combined with the above, in similar dosage, can be given with impunity in any suspected case of poisoning or gastric fermentation. It is soluble in fifteen parts water, and is a powerful oxidizer of organic material, and can be given per orem, through a canula or hypodermatically. A quick method for administration is to have these drugs mixed up in powders or tablets, and dissolve in a half pint of cold water and give at once. In large numbers, a dose syringe can be used. This can be repeated as often as indicated with no injurious effects.

Creosotum, beechwood, combined with camphorae, is particularly efficient in diseases of the respiratory system. An easy method of preparation is to make a saturated solution of the two (using gum camphor) and administer well diluted in oil. Five to ten minims in an ounce of oil is the common dosage; two drams to a pint of oil or syrup being the proper proportion, giving one ounce of this mixture as often as indicated, usually every three or four hours. For acute febrile conditions, the sterile creosoted camphorated oil will be found valuable, the effects being very rapid.

Formaldehydi is a good agent to use in tympanites, in dram dosage, well diluted. If a bunch of animals are stricken at the same time and quick work is essential, add one ounce to a pint of cold water and give a two-ounce dose syringe full as often as indicated.

Magnesii sulphas is a valuable drug to use in mammitis or sprains or bruises. A warm saturated solution is applied locally. As a cathartic it is too slow in action, except in very mild cases.

Flext. phytolaccae is almost a specific in mammitis when used before suppuration has taken place. The dosage is immaterial, as it seems non-toxic. For convenient use, equal parts of this drug and *oleum olivae,* applied locally, may be used, combined with the cathartic mentioned above, in the five-grain dosage.

Trinitrophenol, in a saturated solution (1 to 25 parts boiling water) is indicated in fresh burns, and it has been tried as a vermicide, the dosage being two or three grains, well diluted.

Potassii iodi, in one-grain dosage, is almost a specific for the prevention of goiter in lambs. As a general alterative its properties are too well known to repeat.

Potassii arsenitis in the form of a solution, will be found to be an inexpensive tonic for sheep. It may be combined with any of the stomachics or bitters, as cascara, nux vomica or gentian.

Echinacea or echafolta will be found useful in the pyemia or septicemia group, such as polyarthritis in lambs or puerperal infection in ewes. In extreme weakness the sterile camphorated oil can be administered, and bacterins are always indicated.

Oleum terebinthinae is a valuable agent for any case of fermentation, carminative and gastric stimulant. When alkanet root q. s. and oleum eucalypti is added, it forms a more valuable preparation than when used alone.

Cupri sulphas, so extensively used in strongylosis, soluble in two parts of water, is not only a vermicide of worth, but is also a valuable tonic and alterative. It is claimed this drug increases leucocytosis, and is therefore useful in malnutrition.

Sheep Licks.

Many mixtures are used for licks by sheep men, the efficacy depending on supplying the elements deficient in the soil. For example, "hairless" lambs born with huge goiters were followed the next year by normal lambs, when the ewes were fed small quantities of iodin or potassium iodid during pregnancy.

Salt, sulphur, lime, iron, iodin, bone meal, ginger, copperas, and gentian are common ingredients, and are of great value when used judiciously.

For soils deficient in mineral salts, the following make good licks:

Salt	100 pounds
Calcium phosphate	15 pounds
Sulphate of iron	3 pounds

Mix, and keep from rain.

Salt	100 pounds
Slaked lime	10 pounds
Bone meal	10 pounds
Sulphur	5 pounds

This can be mixed with molasses, kept from rain, and is good for pregnant ewes.

For a good tonic, especially when parasites are present, the following is excellent:

Salt	100 pounds
Iron sulphate	7 pounds
Sulphur	2 pounds
Ginger	1 pound

Mix.

Another good general tonic lick is:

Salt	100 pounds
Copperas	2 pounds
Sulphur	2 pounds
Powdered gentian	1 pound

Mix.

In preparing these licks, care must be taken to mix thoroughly, and it should be remembered that the sense of taste is very delicate in the sheep. Only when very hungry will a sheep eat the smallest quantity of medicine, and it must be disguised as much as possible. Some of the commercial houses are now putting out a very efficient ovine worm powder.

Emergency Medicine Case for the Range.

Before trailing the sheep to the summer range it is well to provide the herders with an emergency medicine chest, and instruct them how to use each drug. Hints may be given for the treatment of a saddle-horse or a valuable dog as well. Less fatalities among the men themselves would occur if the sheep owners would secure a competent physician to give the herders a little talk on "first aid."

For the common emergencies among animals, the following list will be found useful:

One dozen two-inch gauze bandages.
Four one-quarter pound rolls absorbent cotton.
One roll inch zinc oxide adhesive plaster.
Ten pounds sulphur.
Ten pounds Epsom salt.
One gallon raw linseed oil.
One quart castor oil.
One quart glycerin.
One pint hydrogen peroxid.
One pint tincture iodin.
One pint spirit of camphor.
One pint sweet spirit nitre.
One pint tincture of iron.
One quart olive oil.
One gallon turpentine.
One gallon pine tar.
Two hundred, twenty-grain powders containing equal parts potassium permanganate and powdered alum.
Several two-ounce dose syringes.

Disinfectants.

As prevention of disease and parasites is of the utmost importance in sheep industry, a knowledge of disinfectants and their germicidal powers is necessary.

On the western range, very little disinfecting is necessary, except in infected corrals, shearing or lambing sheds, or feeding lots.

Official disinfectants as designated by the Bureau of Animal Industry mention the following:

1. A five per cent solution carbolic acid. Due to its present high price this is very little used.

2. A three per cent solution of liquor cresolis compound. This is a coal tar product. Many other well known coal tar dips such as Kreso, Sanax, Lysol, Chloro-naphtholeum and the like, which are merely trade names of the different manufacturers, are good and efficient.

3. A 1 to 1,000 solution mercuric chlorid. On account of its dangerous properties to animals from licking it, this is not much used for sheep.

4. Chlorid of lime, one pound to one and one-half gallons of water.

5. Formalin, one quart to five gallons of water.

For disinfecting a shed or corral, perhaps as good a disinfectant as any is lime and sulphur dip. Put a half bushel of unslaked lime in a fifty-gallon barrel, and add enough water to make a smooth paste. Add about twenty gallons of water, stirring constantly, and then add the coal tar dip, about three gallons will be sufficient, and fill the barrel with water. Allow to stand over night, and by not agitating the solution, one can use a spray pump with little annoyance from clogging.

The most common western method is to dilute the sediment from the lime and sulphur dips, and throw it around over the corral or pens.

For detailed formulae of the various dips, see Section on Parasites, page 202.

Blue vitriol and common lime are the solutions most used in foot rot on the range.

Biologics.

The administration of serums, vaccines, bacterins and antitoxins has been of wonderful value in combating outbreaks of infectious disease, and in their prevention.

Much confusion has resulted from owners or inexperienced persons using or advising a certain biological product, as blackleg vaccine, when the real trouble was hemorrhagic septicemia. The vaccine was condemned as worthless, many valuable animals lost, and a hotbed of infection established for succeeding years.

It cannot be too strongly impressed upon the stock owner, therefore, to summon expert assistance at the beginning of a disease invasion, for much time, trouble and expense may be avoided by a correct diagnosis.

The hemorrhagic septicemia bacterin is exceptionally efficacious when administered to sheep as a prophylactic, and may also be used as a curative. In cases of chronic, obscure disease, accompanied by atypical symptoms, these may be employed with good results.

In certain parts of the West, it is the custom of large sheep owners to have their lambs immunized against blackleg. The common powder vaccine may be used in one-half to one-fourth the bovine dosage, being made up with distilled water, and not filtered. For more convenient use, the newer products, such as the germ-free "aggressins", "filtrates", and liquid vaccines may be used.

Anthrax vaccine, as well known, was first worked out on sheep, and still is one of the best prophylactics known. If all infectious diseases assumed the characteristic types accompanying anthrax, little difficulty would be met in their diagnosis.

For extremely valuable breeding animals, the Pasteur treatment can be given for suspected rabies, and in tetanus, large doses of tetanus antitoxin administered. However, the expense and probable termination should be carefully explained to the owner, in order to avoid misunderstandings.

Other diseases in which biologics may be used are malignant edema, usually complicated with hemorrhagic septicemia or so-called blackleg; foot rot, in connection with surgery and antiseptics; contagious abortion; sheep pox, septicemia, pyemia, bacteremia and contagious keratitis. The future will undoubtedly add much to this list, as science differentiates the various diseases more fully.

The various pneumonias may be treated hypodermically with bacterins or serums, and creosoted ethereal camphorated oil.

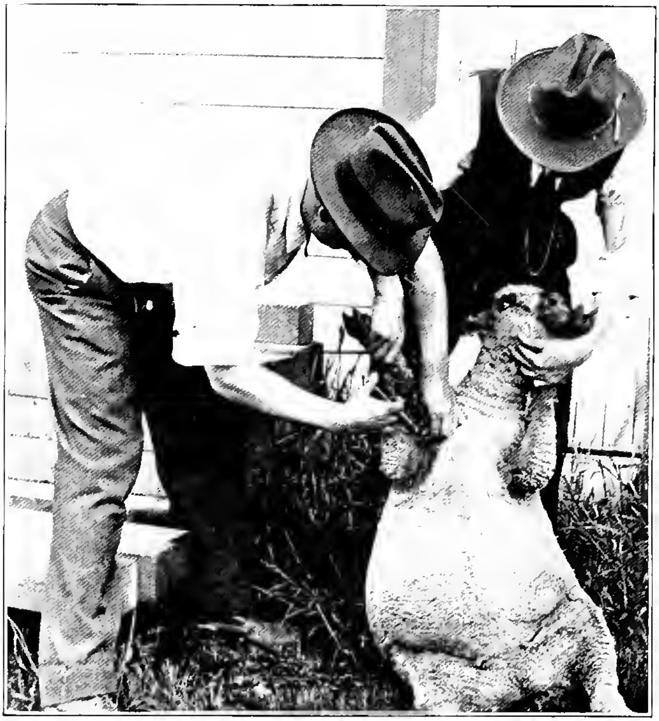
Any part denuded of wool may be used as a site of injection; the axillary space, inner aspect of the thigh or the roll of skin under the ear are convenient.

More attention should be given the subject of hypodermic medication, and it should be performed in a careful, skillful manner.

Postmortem Examinations.

Dr. I. E. Newsom of Colorado gives the following clear procedure of performing an autopsy in the field:

"The following description of a postmortem examination on the sheep gives the routine procedure as gradually developed in my field work on these animals. No originality is claimed for the procedure, nor does it make any claims for completeness. The carcass should always be that of a recently dead animal as putrefaction readily sets in and little is to be determined after postmortem changes have taken place. Slaughtered animals do not reveal the typical lesions of hemorrhagic septicemia as well



VACCINATING.

Using the axilliary space as a site of injection. In large bands the sheep may be held on a low table.

as those that have died from the disease. It seems that the hemorrhages typical of these disturbances take place just before death.

"Remove the skin or better have it done by an attendant who is usually more skillful at it than the average veterinarian. However, the skin should be removed in the presence of the operator in order to determine the condition of the subcutaneous tissue, also to catch the subcutaneous lymph-glands which are frequently removed with the pelt. Incise the subcutaneous lymph-glands, submaxillary, precapsular, precrural and finally the popliteal. Lay the carcass on the left side, open the larynx and slit the trachea to the base of the neck, examining the interior of these organs. Remove the fore limb on the upper side by severing the muscles which hold it to the thorax and lay it over dorsally. Raise the upper hind limb and cut the muscles to the coxo-femoral articulation, severing the ligaments of this articulation and lay the limb back over the carcass. It need not be entirely removed. Next pass the point of the knife through the abdominal muscles just back of the last costal cartilage which is attached to the sternum. Pass the knife forward severing the connection between the costal cartilages and the sternum. It will be found that the knife will pass more readily through this area than through the middle of the sternum. Care should be used not to push the knife through sufficiently far to injure the lung or heart. Go back to the starting point of the incision and pass the knife through the abdominal wall near the median line posteriorly almost as far as the pubis, then carry the incision high up in the flank. The whole flap then, consisting of the ribs of the upper side and the abdominal muscles, may be lifted, and by cutting the diaphragm this flap may be pressed dorsally until the ribs break loose at their vertebral attachments. This exposes both the thoracic and abdominal viscera in their normal positions. It should be attended without cutting any vessels of sufficient size to obscure any of the lesions by means of blood. Examine the lung, slit the pericardium so as to examine the exterior of the heart. The heart can then be raised, the pericardium severed from its sternal attachment, and the lower pleural cavity examined with its lung. The pluck may then be removed by cutting across the trachea and through the large vessels. That portion of the trachea attached to the lung and the bronchial tubes can then be examined by slitting lengthwise. The heart cavities can be readily opened and their contents inspected.

"Pass now to the abdominal viscera, examining the small and large intestines, particularly the duodenum and the fourth stomach in situ. It is better, however, not to open these organs until they have been removed from the cavity. Proceed then to separate the stomachs and intestines from their attachments and roll them out. Open up the four stomachs and note their contents and the condition of the lining. Slit the intestines at several points to determine their condition. Examine the mesenteric lymph-glands. As the rumen is removed, the spleen will come into view and should be examined. The liver can then be removed and the hepatic ducts slit open to determine the presence of parasites. Then remove the kidneys and slit them lengthwise for inspection. The bladder and internal genitals can now be examined.

"Next pass to the examination of the head. The nasal and cranial cavities should be opened, which can be conveniently done with a chisel having a blade rounded from side to side. In fact, this instrument has preference over any bone-cutter which I have seen. Both the cranial and nasal cavities are of importance in sheep examinations because of the possibility of parasites in these two regions. This constitutes the routine examination but of course may be varied to suit special occasions."

Veterinarians will do well to follow the foregoing directions.

Lymph Gland Areas.

A few words as to the location and drainage districts of the most important lymph-glands may be useful for reference.

The lymph, collected from all parts of the body by the minute lymphatics, finally empties into the thoracic duct, except from the right fore limb, right side of neck, thorax and head, which empty into the great lymphatic vein. The thoracic duct originates in the receptaculum chyli, which is situated beneath the first lumbar vertebrae, near the kidneys. Passing along the lower surface of the dorsal vertebrae, it passes through the diaphragm, to the apex of the thorax, and empties into the anterior vena cava. The great lymphatic vein is very short and empties into the venous system at the junction of the two jugulars.

The submaxillary lymphatic gland is located between the inner aspect of the inferior maxillary bone and the submaxillary salivary glands.

The postpharyngeal or retropharyngeal lymph-glands are found at the base of the cranium between the branches of the hyoid bone. These are the outposts of the digestive and respiratory systems, and are usually infected first when these two parts of the body are diseased.

The superior cervicals are located at the extreme superior end of the submaxillary salivary gland.

The prescapulars are located a little above and in from the shoulder joint, covered by the mastoido-humeralis muscle, and embedded in fat. When these are infected, it is usually a sign of generalized disease.

The prepectoral glands are located at the entrance to the thorax, between the first two ribs. These guard the districts from the head, neck and fore limbs.

The precrural glands are found in the flank, above and slightly in from the femero-tibial articulation. This is a very commonly infected gland in sheep. An incision a little to one side of the umbilicus will usually reach them.

The mesenteric lymph-glands in sheep are composed of long continuous masses, found along the lesser curvature of the intestines, in the mesentery or "ruffle fat."

The remaining lymph-glands are of more importance to the meat inspector than to the veterinarian in the field.

Rubber gloves should be worn, an antiseptic used, and the carcass so burned or heated that it will not prove a menace and produce further infection.

Sometimes several or more autopsies are necessary to arrive at a correct diagnosis, and even then it is often the safer method to make a guarded one.

Preparing Specimens for the Laboratory.

In order to derive the greatest aid from a bacteriological examination, the veterinarian performing the autopsy should take the greatest care in selecting and preparing the specimens for the laboratory. Dr. Newsom gives the following helpful suggestions:

"The diagnosis of disease by means of laboratory procedure has in recent years received considerable emphasis, and while the method is of great assistance in properly selected cases, there is a tendency on the part of some to base too much reliance upon laboratory findings. In too many instances material is selected at random, sent in to a laboratory for examination and the findings given undue weight in the final determination of the case. Laboratory reports should be considered as evidence very much of the same kind as the temperatures, the symptoms, the lesions and the general surroundings, including food, but in order to arrive at a proper and safe diagnosis all of these things must be thoroughly considered and given their due weight. In sending material to a laboratory, it is always wise to send a full and complete history of the case in so far as this is possible to obtain, including symptoms and lesions. When approached in this attitude a laboratory determination may be of great value. If entire dependence is to be placed upon the laboratory examination, then it is quite probable that better results might be obtained by taking the clinical aspect of the case and making the determination on that alone. Much of the material received by laboratories is either poorly selected or poorly prepared, so that the object in sending it has been defeated. The practitioner should have in mind some particular disease and select material which will be of value in the examination for this trouble. Material selected at random is seldom usable.

"A great difficulty comes in properly preparing organs so that they will not undergo putrefaction during transport to the laboratory. The method which has been most satisfactory in my work is as follows: Select whole organs, such as the spleen, kidney, lung and heart or liver, wipe them dry with a clean cloth, wrap them in several layers of surgeon's gauze or cheese cloth which has been previously soaked in a 1 to 1000 solution of bichlorid of mercury and the excess water wrung out. Then pack them with loose paper in a box and ship. Never put organs of this kind into a tight can, as such treatment favors putrefaction. The use of whole organs not only gives material for bacteriological examination, but also gives a fair idea of the lesions as well. Material selected from fresh carcasses and packed as above will frequently stand at ordinary temperatures for a week without showing much change.

"Where a bacteriological examination is not desired, as in the case of tumors, generous sections may be put up in a 10 per cent formaldehyd solution. Parasites are also preserved nicely in the same way. Bottles of blood unless taken under sterile conditions usually undergo putrefaction so quickly as to be of no practical value in diagnosis. It is very rare to receive a bottle of blood that was taken under sterile conditions. If anthrax is suspected, an ear can be wrapped as above stated and will go through in good condition, giving the laboratory man all that is necessary for the diagnosis of this condition. However, in case of the negative finding for this disease, it would be well to have other organs in order to determine the presence of other infectious diseases."

Examination of a Sick Sheep.

In examining a sick sheep it is best to have the owner or shepherd restrain the animal; this avoids any undue excitement.

The temperature should be taken per rectum; the pulse over the heart, and respirations by observing the movements at the flank.

The eyes, conjunctival membranes and suborbital glands, together with the nostrils, should be next examined. Frothing at the mouth and grinding of the teeth is often a symptom of intense pain.

In warm weather, a very careful search should be made for maggots. Often a wound with a very small aperture may contain a cupful of these parasites, with a resultant sapremia.

The color of the skin should be observed, and the interdigital glands examined.

In case several or more are sick, and a definite or even tentative diagnosis impossible to make from clinical symptoms present, one should perform an autopsy on one of the worst affected. Specimens should be sent for bacteriological examination, to confirm the field diagnosis. While awaiting results from the laboratory, change the sheep to other quarters; isolate the apparently healthy from the sick, and use any other measures indicated.

In no line of veterinary practice is judgment and experience of more value than in the control of diseases of this kind.

One should not rely too implicitly upon the history of the case as related by the owner or caretaker, for, unfortunately some of these individuals trace a direct lineage to Ananias. It should be impressed upon these persons that a perfectly frank and truthful statement may be of great value in clearing up doubtful cases. The duration of the illness; the number affected; the number dead; if any new additions have been made recently to the flock, and all other details that the occasion demands.

As there are so many things to remember about ovine pathology, a simple classification may easily be carried in mind. The author, in his practice, has evolved the five following classes that may be encountered in everyday routine:

1. Parasites. Two divisions of these may be recognized:
    - A. External; the common ones being scab mites, ticks and maggots.
    - B. Internal; such as gid, grub, lung worms, stomach worms, fluke and tapeworms.
2. Poisons, usually of a vegetable character, such as moldy food or toxic plants.
3. Infectious diseases; the common ones being hemorrhagic septicemia, anthrax, so-called blackleg, tetanus, rabies, foot rot, and septicemia. One should be familiar with foreign diseases such as foot and mouth, rinderpest and variola, to such an extent as to think of them in baffling infections.
4. Non-infectious diseases, mostly of a digestive or pulmonary character.
5. Miscellaneous, as expert testimony, enforcing sanitary regulations, and public addresses.

Keeping these in mind may keep one from becoming confused. The inexperienced too often think of the out of the ordinary. For example, simple foot rot may be pronounced lip and leg ulceration; alopecia due to mammitis mistaken for scabies; plant poisoning for rabies, and so on.

CHAPTER VI

ACUTE INFECTIOUS DISEASES.

Comparatively few contagious diseases attack sheep, but when they do, the results are disastrous, unless promptly controlled. It is in such epizootics that the value of veterinary science is properly appreciated, provided the services be rendered in a skillful manner. Every means for a careful and accurate diagnosis should be made, and whenever possible, the clinical diagnosis should be supplemented by a bacteriological examination.

Much loss could be avoided if the owner would promptly secure the services of his local veterinarian at the onset of a disease outbreak. The latter should be prepared to handle these cases, by giving first aid or emergency treatment; notifying the proper state or Federal officials in case of contagious disease, and by advice to the owner in controlling the trouble.

In the East and South, among small bands of sheep usually kept under artificial conditions, care must be taken to differentiate the infectious diseases from digestive disturbances, lack of exercise or parasitic invasion.

In the West among large bands of several thousand head or more, the greatest difficulty is in determining whether the causative factor is a poisoning of some kind or the invasion of pathogenic organisms. The large ranges over which the sheep rove may contain springs or creeks impregnated with mineral poisons, as arsenic, lead, zinc or copper. Precipitous canyons, ledges and gulches may harbor toxic plants. The case is rendered still more difficult in that the affected animals may be located several days' journey from a railroad station, and several hundred miles from a bacteriological laboratory. In these cases experience is the best aid, and should the veterinarian possess enough foresight to take along a sufficient quantity of biologics or common chemical antidotes for immediate action, his scope of usefulness will be greatly widened. Nothing is so embarrassing as to diagnose blackleg or hemorrhagic septicemia and then find one-self minus a hypodermic syringe, or with no vaccines or bacterins.

In other words, the stock owner wants results, and he is absolutely unconcerned how these are obtained. Beautiful theories fall by the wayside, and the man who can promptly diagnose an outbreak of infectious disease; administer appropriate treatment; isolate the healthy from the sick, and cut short an epizootic, is the man who wins the approval of the stockmen.

1. Hemorrhagic Septicemia.

Catarrhal fever of sheep; septicemia hemorrhagica ovis; infective pneumo-enteritis; pasteurellosis; plague. It is also found to be the exciting cause in some outbreaks of "cornstalk disease," "mad itch," "blind staggers," cerebrospinal meningitis, dysentery, bloody flux, "murrain," and conditions known by many other colloquial terms.

As it often appears simultaneously with outbreaks of anthrax, malignant edema and blackleg, its importance as a mixed infection is just beginning to be realized.

The disease has been described under many different names by writers in all countries. Attention was first drawn to hemorrhagic septicemia in Europe in 1878, when it assumed the proportions of an epizootic among deer, and was known as the "deer and cattle disease." In 1885 our Bureau of Animal Industry identified as the causative agent of this "deer plague" the same organism found in swine plague. For the next twenty-five years very little definite knowledge was gained, as the disease assumed so many different forms, attacking all domestic and even wild animals. Wilson and Brimhall, of Minnesota, in 1899, contributed a valuable addition to our knowledge of the disease, while Newsom of Colorado has recently carried on an exhaustive research on the ovine type. Lytle, of Oregon, made the first investigations of the disease affecting sheep on the range, and successfully used the bacterin made from cultures of the ovine type of the hemorrhagic septicemia organisms. In 1911 a strange infection suddenly attacked the buffaloes in the Yellowstone National Park, which, after a bacteriological examination was found to be due to the invasion of the hemorrhagic septicemia organism. By the use of an autogenous bacterin the disease was controlled. Since then much valuable investigation has been carried on by various workers, and the true significance of hemorrhagic septicemia, as a primary disease or as a secondary factor, is beginning to be fully realized.

In the past several years, many cases of obscure maladies among our domestic animals have been found to be hemorrhagic septicemia, either alone or in conjunction with some other disease. On account of it assuming so many guises, appearing at first in a virulent form and rapidly subsiding, becoming chronic, or attacking animals isolated from all possible sources of infection, the knowledge we have of its ravages today is due to repeated bacteriological examinations.

Sheep Killed by Hemorrhagic Septicemia.

Cause: The Bacillus ovisepticus, or Bacillus bipolaris septicus, a short, non-motile, non-spore-forming organism. It is about one-twenty-eight-thousandth of an inch long, and one-thirty-eight-thousandth of an inch in width. It does not stain by Gram's method, but does stain with the anilin dyes. Often the bacillus stains very distinctly at each end, with an almost transparent center. It is ovoid in shape, and grows in bouillon, agar and gelatin. It does not liquefy gelatin, sour milk, nor form gas in sugar media.

Bacilli closely resembling the true organism are widely distributed as harmless saprophytes, and may be found in the air, soil, water or plants. A plausible theory is that these comparatively benign germs enter the systems of poorly nourished or peculiarly susceptible animals and increase in virulence until they assume the pathogenic violence of an epizootic. This may explain why outbreaks have occurred among bands of sheep isolated in high mountains, far away from any possible source of animal infection by additions to the flock. After the virulence spends its force, the disease becomes self-limiting, finally abates, and the organisms again assume their quiescent form. Much remains to be learned about hemorrhagic septicemia, and the future will undoubtedly reveal much of value to the investigator.

The bacilli may enter the body by the skin, as in blackleg; by the lungs, as in pneumonia; and through the intestinal tract, as in enteritis. Because of these erratic invasions, no two cases may assume the same form. It is this phase of the disease that makes hemorrhagic septicemia so difficult to diagnose without the aid of a bacteriological examination. It is also very difficult to convince the stock owner that so many different "diseases" may be caused by the same germ.

The bacilli are found in the blood and in the hemorrhagic spots. The exact mode of transmission is not definitely known, neither do animals of different species infect each other as a rule. Unlike anthrax, no case of infection in man has ever been noted.

Symptoms: As above stated, it is very difficult to give a clear clinical picture, as in blackleg. The presence of small hemorrhagic spots in the diaphragm, heart walls, fourth stomach and intestines, not accompanied by gas-forming lesions, may greatly help one to arrive at a probable diagnosis.

Often it first appears in the peracute form, and one to many sheep are found dead before any symptoms of illness have been noted by the owner. Some time later, several more may be found dead, and others show signs of sickness. The latter seem weak, refuse to eat, have labored respiration, with drooling from the mouth, and uncertain gait; later, toward the end, convulsions or "fits" take place. The temperature will be found very high, running from 106 to 110° F. There may be great thirst, which is more often seen in the chronic type, and the clinical picture may greatly resemble plant poisoning, blackleg or pneumonia.

Three forms of hemorrhagic septicemia may be differentiated: the pectoral or pulmonary; the intestinal; and the skin or exanthematous form. Each of these may assume either the peracute, the acute or the chronic type.

1. *Pectoral or pulmonary form.* The victim is usually found dead, or, if alive, standing with legs spread wide apart, breathing rapidly, and with a frothy, bloody exudate coming from the mouth or nose. The eyes may be bloodshot, with a slight discharge of mucus. Frequently the animal seems to suffer colicky pains or the "stretches" before going into a fatal convulsion. Muscular tremors similar to strychnin or other plant poisoning may be present. This applies more particularly to the acute type, as those with the peracute type are usually found dead, or drop over in an apoplectic fit. The chronic type greatly resembles pneumonia in its various phases. The course of the pectoral form may be from several minutes to a couple of weeks, the usual duration being from one to three days.

2. *Intestinal form.* This is often secondary to the pactoral. There is profound depression, later merging into stupor, as the animals lie on their sides, and apparently are dead. At first, there is constipation, followed often by a diarrhea containing traces of blood or shreds of mucous membrane. This type often resembles forage poisoning, and in cases where slightly molded silage or alfalfa is fed, the greatest trouble is to differentiate hemorrhagic septicemia from this group of intestinal toxemias.

3. *Exanthematous or skin form.* This is rather rare in sheep, due to the protection by the wool. However, in epizootics where lesions simulate necrobacillosis invasion, with unusual fatalities, one should be on guard for hemorrhagic septicemia. This form is very difficult to differentiate from blackleg, malignant edema or anthrax, although in the two former gas is found, while an examination of the spleen will dispose of the latter.

Anatomical changes: In the pectoral form, there may be found in the lungs areas of hepatization, with purplish spots. The coverings of the lobes may be greatly inflamed, while the fluids will be of a bloody, frothy nature. By carefully keeping the diaphragm free from blood numerous small hemorrhagic spots, ranging from the size of a pinhead to that of a bean, will be found. Similar and even larger petechiae may be found on the pericardium and walls of the heart, near the large vessels.

The lymphatic glands may be swollen and hemorrhagic.

The fourth stomach may be found very much inflamed.

In the intestinal form, much inflammation of the mucous membrane may be found, and enteritis present. The kidneys may be injected, with many hemorrhagic spots in the connective tissues, as well as in the lymph-glands.

In the exanthematous form swellings may be found on the shoulder, rump, and on the throat, resembling blackleg; however, there is no gas present.

In all forms the spleen remains normal.

Differential diagnosis: Blackleg usually attacks lambs only, and on known infected soil. There are the characteristic gaseous lesions, with the well known "crinkling" sound, when the hand is passed over these swellings.

Anthrax is easily distinguishable by the "blackberry" spleen. It runs a rapid and fatal course, spreading to other animals, including man. The greatest difficulty is encountered when anthrax and hemorrhagic septicemia appear in the same outbreak.

Malignant edema is characterized by the formation of gas, and is more of a wound infection disease, following castration or docking.

Plant poisoning is unaccompanied by the hemorrhagic spots in the thoracic or abdominal viscera, although a severe enteritis may be present. The sudden onset of the outbreak, the presence of toxic plants, and characteristic convulsions, all help one to diagnose the trouble as poison.

Pneumonia assumes a more constant, febrile type, with less rapid exhaustion and emaciation. Usually, the lungs are the only organs exhibiting lesions, while a history of exposure will lead to a comparatively easy diagnosis. However, when hemorrhagic septicemia occurs coincidently with pneumonia, the diagnosis may be rendered still more cloudy by the presence of bipolar organisms found upon a microscopic examination.

In all cases where there is the least doubt, a bacteriological examination should be made. The pluck (heart and lungs) should be taken from a fresh carcass, packed on ice, and sent to a laboratory as quickly as possible. A complete history of the case, with clinical symptoms, and other data obtainable will help the pathologist in his work. Where this procedure is not feasible, small pieces of affected tissue, glands or muscle may be sent, rolled in boric acid, or immersed in glycerin or alcohol. Small vials of blood may also be sent. These, however, are of little value to the laboratory worker, and may be the means of clouding an otherwise correct field diagnosis.

Above all things, when performing an autopsy, use precautions that give to the operation a scientific character, and prepare specimens for the microscope carefully. This will insure prompt service by the laboratory and more accurate findings. Nothing is gained by sending specimens from animals dead for some time, and the information may lead to further confusion.

These suggestions will be found valuable in any contagious disease where a bacteriological examination is desirable.

Treatment: The only logical procedure is the immunization of all exposed animals. Specially prepared bacterins of the ovine type of hemorrhagic septicemia are now available.

Mixed bacterins have been used in some cases with success.

Where lesions of blackleg are found, a dose of that vaccine also may be administered.

In outbreaks where the pneumonia symptoms predominate, immunization with the pneumo-bacterins may be given along with the hemorrhagic septicemia bacterin.

Immediate isolation of the apparently healthy from the sick and a complete change in feed, water and range is indicated. If the outbreak occurs in winter and this is impractical, run the apparently healthy sheep through a trough containing any warm antiseptic. The solution should be several inches deep, so as to disinfect the feet. One part coal tar dip to sixty of water; five pounds copper sulphate to one hundred gallons water; or the lime and sulphur dip may be used. Scatter lime freely about the new quarters. While the organism is very easily destroyed, disinfection of the premises and then returning the animals to them will be found very unsatisfactory.

Either the axillary space or inner aspect of the thighs may be used as the site for injection of the bacterin. In large bands the sheep may be set up on the rump and quickly immunized in the axilla, or the animal may be laid on a table, waist-high, and vaccinated in the inner aspect of the thigh. By these methods, one or two thousand animals can be immunized per day by one operator with a minimum of fatigue. Short, rather thick hypodermic needles are desirable and several syringes should be available, and frequently cleaned to prevent gumming. Antiseptic precautions are not necessary except to keep the syringe and hands clean.

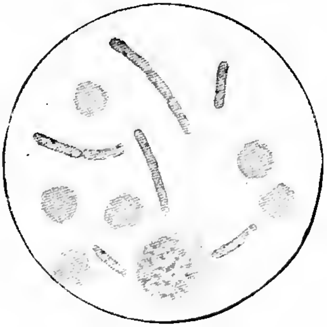
In case no ovine hemorrhagic septicemia bacterin is at hand, the bovine type may be used. Should neither be available, blackleg vaccine in one-half the ordinary bovine dosage may be administered, while waiting for the arrival of the bovine hemorrhagic septicemia bacterin. However, these are merely emergency suggestions, and should be used only as a last resort.

Medicinal treatment will not be found very satisfactory. General tonics are indicated, but after immunization, comfortable quarters, abundant food and water, with sufficient exercise, will be found to be the best after-treatment.

2. Anthrax.

Wool-sorter's disease; splenic fever; splenic apoplexy; malignant pustule; anthracemia; charbon; Miltzbrand.

Anthrax has been known under various names since the earliest times. Virgil has described an infectious sheep disease transmitted to the wearers of hides and wool taken from sheep dead from the malady. The Arabs called it "Persian fire," and it became a terrible scourge in southern Europe in the sixteenth century. It is now prevalent in all parts of the world, but fortunately, is found in only circumscribed areas in the United States. Strict quarantine, isolation from infected pastures, drainage and cultivation of the pasture land, and immunization has held this fatal disease in check.



(From Hutyra and Marek)

BACILLUS ANTHRACIS.

Fresh sheep blood stained with diluted Fuchsin solution.

Cause: The Bacterium anthracis, a square-ended, rod-shaped germ, about one fifteen-thousandth of an inch long, and one twenty-five-thousandth of an inch wide. It grows well in gelatin, blood, broth, agar and potatoes. It is found in the blood in all parts of the body. The bacilli are easily stained with the anilin dyes and by Gram's method. The bacillus itself is rather delicate, but the spores are extremely resistant to exposure.

The spores are formed outside the animal body by the ends of the bacilli becoming elongated. The protoplasm becomes filled with very small granules, which change into the oval bodies or spores. The transition from a spore to a bacillus is equally interesting, and is merely an elongation of the spore, from which the rod appears, and the spore disappears. The spores retain their virulence for many years, and often transform themselves into bacilli in warm, moist soil. This is why it assumes such an important place in southern districts, such as in the lower Mississippi valley.

The bacilli are destroyed by putrefaction; and sunlight greatly inhibits their growth. They grow best in a temperature of 95° F. Salting hides will cause the death of the bacilli within twenty-four hours, but the spores retain their vitality for years.

Our knowledge of the Bacterium anthracis dates from 1885. and extensive researches into its pathogenic nature have been made since.

Symptoms: While in general anthrax attacks very suddenly, three different types may be seen:

1. Peracute or apoplectic, in which the animal may suddenly be seized with slight shivering, fall down, attempt to rise, stagger a few steps in a wild, frenzied manner, and die in a convulsion, all within a few minutes. Dark, bloody, frothy discharges ooze from the mouth, nostrils and anus. Usually, in sheep, this is the most common type, and the animals are found dead in the pasture or pens.

2. Acute type, in which the symptoms are similar to the peracute except prolonged for several hours.

3. Subacute, which is rarely found in sheep. An intense diarrhea, constant wagging of the tail, with labored respirations and cerebral excitement is shown.

The period of incubation is very short, from one to three days, and the duration of the disease from several minutes to a day, with a very high rate of mortality.

The animal may be infected through the alimentary tract, the skin, or through the respiratory system. The route through the skin, as in blackleg, is the most frequent method of infection in sheep, although ingestion of the spores, no doubt, causes severe outbreaks. The bacillus may be spread by all kinds of intermediate carriers, such as dogs, birds, flies, salted hides, hair brushes, woolen articles and the like.

Anatomical changes: The spleen is the first organ to examine. In anthrax it is greatly enlarged, and the pulp is of a "blackberry jam" consistency and color.

The blood is a dark, tarry-like color; does not coagulate readily, and shines with a gloss like varnish.

The liver and kidneys may be slightly enlarged, with small hemorrhagic spots, which may confuse one with hemorrhagic septicemia.

The lymphatic glands usually are full of dark spots, and show great congestion.

The neck is often edematous, and the trachea may be injected.

The heart is filled with dark, tar-like blood.

Carbuncles or external lesions may be present or absent, depending on the channel of infection.

The morbid anatomy in general is much like that of any highly acute septicemia or blood poisoning, while the splenic lesions differentiate it from the other diseases of this group.

Differential diagnosis: Blackleg is characterized by gas formation, lack of splenic lesions, and the longer duration of the disease.

Hemorrhagic septicemia, by the characteristic spots found more generally throughout the abdominal and thoracic viscera, with a normal spleen. When both diseases are suspicioned in one outbreak, a bacteriological examination should always be made.

Malignant edema is more of a wound infection disease, accompanied by the formation of gas, and a normal spleen.

Plant poisoning is differentiated by the absence of the dark, tar-like blood; a lack of general septicemia-like lesions, and a normal spleen is present.

Rabies is differentiated by the absence of lesions, and by the history.

The history of the case will lead one to an accurate diagnosis, as infected districts are visited from time to time with fatal outbreaks, unless constant immunization is practiced, and even then one or more animals may be found dead, to disseminate more spores.

Treatment: First, accurate diagnosis.

Second, rigid quarantine.

Third, burning of carcasses, blood and infected material.

Dalrymple states that as the virus becomes attenuated, a good many cases recover.

Fourth, immunization and change to different quarters. The owner should be informed that when animals are inoculated in an outbreak, some animals may harbor the spores, and die before the vaccine can take effect. This little precaution will protect the veterinarian and give the vaccine a better reputation.

Unlike blackleg vaccine, which is commonly made from dried muscle of dead calves, anthrax vaccine is prepared by cultivating pure cultures of the disease in beef broth. Recently, many improvements have been made in serum therapy, such as spore vaccines, filtrates and serums. These are on the market, ready for immediate use, and veterinarians located in infected districts should always keep a supply on hand. Wise owners will have their animals vaccinated each year as a precautionary measure, for the loss of several animals will more than offset the expense, while the disease will be greatly disseminated, and keep the farm a constant menace to people, as well as to live stock, for all warm-blooded animals are susceptible.

The first attempts to immunize animals against anthrax were made by Pasteur in 1881 on sheep. So successful were his first experiments that hundreds and thousands of sheep were inoculated annually in France, and in many districts the disease was almost eradicated.

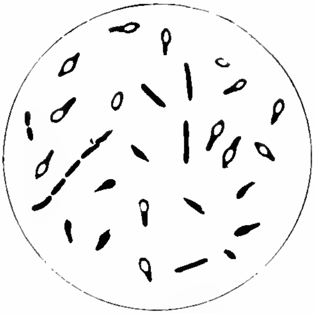
The very best thing one can do on the appearance of this disease is to notify the nearest Federal or state live stock official by wire. Veterinarians should disabuse themselves of the belief that it is a reflection upon their professional ability and skill to call upon state or Federal authorities in outbreaks of disease that are suspected of being highly contagious and susceptible of control only by concerted public action. It demonstrates better ability to take this precaution a hundred times where later developments reveal it unnecessary than to fail to take it one time and thus permit the unnecessary infection of wide areas and consequent great loss, perhaps for years to come.

3. Blackleg.

Black quarter; quarter ill; symptomatic anthrax; gangrenous emphysema; charbon.

Blackleg in sheep has been questioned by many investigators for lack of experimental data. However, the writer and other practicing veterinarians have had outbreaks of disease in sheep that were promptly controlled by the use of blackleg vaccine. Recent English investigations have proved that blackleg and braxy are almost identical, and some forms of hemorrhagic septicemia are closely related. These finer distinctions are of more value to the laboratory worker than to the man in the field, and the latter will be satisfied to call a disease that can be promptly controlled by blackleg vaccine, the well known and common malady. Further investigations will undoubtedly throw more light on this point.

Stock owners are not interested in pathological findings; their vital concern is in the prompt control of diseases that may ravage their flocks and herds. In some parts of the West, some sheepmen have their lambs immunized before leaving for the summer range. Prior to doing this, they would lose from fifty to five hundred lambs every year; now they graze their flocks with impunity on known infected soil, where undoubtedly spores are harbored.



Bacillus of Blackleg.

Perhaps no malady with which we are familiar retains so characteristic and easily diagnosed symptoms, and none so promptly responds to immunization.

Cause: The *Bacterium Chauveaui,* a rather thick, spore-forming organism, with rounded ends. It is about one six-thousandth of an inch in length and one twenty-thousandth of an inch wide. It stains readily by Gram's method and the anilin dyes. It grows well on broth or agar, and in blood devoid of oxygen, being an anærobe. It forms much gas, and spores within the dead body.

The exact period of incubation is not known, but it is probably from one to three days. The course of disease is rapid, with a high mortality.

The first accurate description of blackleg as a distinct disease was written in 1856, although the malady had been described for many years. In 1880 the specific organism was isolated, and soon after the well known attempts at immunization were made. An attenuated vaccine was used, and the beginning of animal inoculation for the prevention of disease was begun.

For years, the vaccine was prepared only in the powder form from triturated muscle. Later, came the familiar blacklegoids, and more recently, the filtrates, aggressins, serums and liquid vaccines. These are more convenient to use, safer, and perhaps more efficient than the powder.

Symptoms: Young sheep, usually under one year of age, are the common victims, spring lambs succumbing in July or August when driven onto infected ranges. The first symptom noted is depression, lack of appetite, and falling behind the rest of the sheep. Later, the animal may limp; lie down frequently; respirations are labored; frothing at the mouth ensues, and convulsions may follow just before death. The temperature will be found very high, running around 110° F., with all the concomitant symptoms of a violent and acute blood poisoning. The herder immediately diagnoses the trouble as plant poisoning; slashes the ears or throws the unfortunate victim in the camp wagon, and thinks nothing more of it. Later, if many die, he may inform the owner. It is then a veterinarian is summoned.

Anatomical changes: Fortunately, blackleg is very easily diagnosed, as it maintains a fairly constant course. Soon after death the carcass becomes greatly distended with gas. The subcutaneous tissues are filled with a blubbling, frothy exudate, and this may ooze from the nostrils, mouth or anus. Swellings may be found on the neck, shoulders, loins or legs, but this condition is not always present. As lambs are not covered with a protective coat of wool, any portion of the anatomy may show emphysematous swellings, which give forth the well known "crinkling" sound to the touch.

The spleen is normal.

Differential diagnosis: Hemorrhagic septicemia is accompanied by the characteristic petechiæ. It attacks sheep of all ages; blackleg attacks lambs in greater numbers than adult sheep. The diagnosis is rendered more difficult if both diseases occur together, in which case the morbid anatomy may be very confusing.

Anthrax is known by its "blackberry spleen." In case of an incomplete or indefinite bacteriological examination, animal inoculation may be resorted to. A rabbit is immune to blackleg, but a guinea pig will quickly succumb to it.

Malignant edema is more of a wound-infection disease, following castration, docking, ear-marking or animal bites. It is also rather rare, and can be definitely diagnosed only by the aid of a microscope.

Poisoning is not accompanied by the exceedingly high temperature of infectious diseases; there is usually no emphysematous swellings, or hemorrhagic areas, although a severe enteritis may be present.

Treatment: Immunization of all exposed animals and removal to another range is the practical method of control. For valuable breeding animals, serums may be used, but the disease is so acute, that by the time the diagnosis is made, it is too late for any treatment.

The ordinary bovine vaccine can be used in one-fourth to one-half the dosage given calves. The liquid vaccines, filtrates or aggressins are by far the most convenient, and the expense per animal is small. In cases where there is the least reason to suspect the presence of hemorrhagic septicemia, the bacterin for that disease should be simultaneously injected in the opposite thigh or axilla from the one in which the blackleg vaccination is given. The technic of vaccination is the same as described at length in the chapter on hemorrhagic septicemia.

While blackleg is rather rare in sheep, or the disease which we call blackleg for want of more definite information, one outbreak caused the death of over four hundred sheep before expert assistance was called. Every known antidote for plant poisoning had been tried without success. Immunization with bovine blackleg vaccine promptly controlled the epizootic without further loss. Another instance in the writer's practice was the sudden invasion of a mysterious ailment among twelve thousand sheep being fed in winter. Forage poisoning, lupine, "doping" by some unknown enemy, and many other theories were advanced, until immunization with blackleg vaccine was suggested. All the animals were vaccinated with no further loss. Previous to this, the loss has been around six hundred daily for several days.

4. Malignant Edema.

Edema malignum; septicemia gangrænosa.

The so-called "fire" of sheep in many countries is probably this disease.

Cause: The Bacillus edematis maligni, an anærobe about one six-thousandth of an inch long and one twenty-five-thousandth of an inch in width. It is motile and forms spores like anthrax. Its growth is inhibited by putrefaction.

This is a wound-infection disease, and often follows castration, ear-marking or docking on infected soils, or in corrals where animals have died the previous year. The germ greatly resembles the causative factor of anthrax, except that it has rounded ends, and grows in the absence of oxygen.

Symptoms: In general, the clinical picture is much the same as that of blackleg, except that it attacks sheep of any age. Usually, the victim is found dead, and others may show vague symptoms indicating that something is not exactly "right." In these, the temperature will be found very high; crepitating swellings may be felt on the body, especially on the inner aspect of the thighs, over the rump, and on any of the parts denuded of wool. The respirations are labored; the pulse is weak and very rapid, while the visible mucous membranes are cyanotic.

The clinical symptoms and anatomical changes are so similar to others of the septicemia group that only a careful bacteriological examination will give a definite diagnosis.

Differential diagnosis: It differs from anthrax in that the spleen is normal.

From poisoning, the chief difference is the presence of edematous swellings and the formation of gas in the subcutaeous tissues.

Only a bacteriological examination can differentiate the disease from blackleg, except that it attacks sheep of all ages, while blackleg confines its so-called attacks on yearlings or younger lambs, as a rule.

The history is also helpful, but one should be very guarded as to diagnosis.

Treatment: This is a rare disease among sheep, and is very seldom seen on the range. It is usually found around the barnyard and in low, damp areas.

No successful treatment has so far been found.

Prevention consists in moving the sheep to another range, preferably to a higher one.

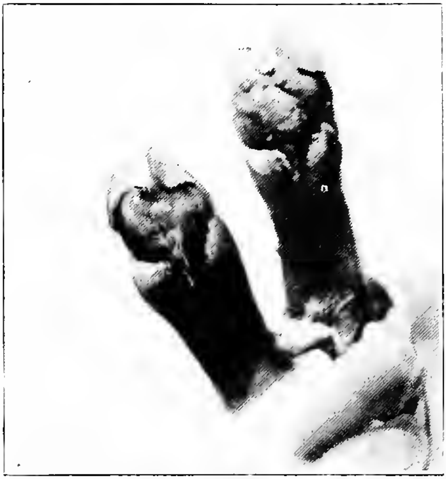
5. Foot-and-Mouth Disease.

Apthæ epizooticæ.

Probably no disease appearing among cloven-footed animals in this country has been so thoroughly discussed in the past several years as this one, consequently a mere summary is given here.

Cause: Unknown. The clear serum-like contents of the vesicles and the blood carry the contagium.

Symptoms: As this is an acute febrile disease, the first symptom noted is a high temperature usually accompanied by a slight lameness. The foot becomes swollen, feverish, and small vesicles which later become pustules are found in the interdigital space. Upon squeezing these, thick pus comes out in a spiral, worm-like shape, hence the colloquial term, "hoofworm." Great care must be used to differentiate it from foot rot. Complications, such as lack of appetite, abortion in pregnant ewes, and vesicles on other parts of the body, as in the mouth and sometimes on the teats, may help one to exclude any form of rot. In the latter disease the hoof becomes gangrenous, and to one who has seen both, the difference between these two disorders is very noticeable. The history of an attack is perhaps more important in arriving at a diagnosis than are the lesions. The fact that



Showing Effect of Foot-and-Mouth Disease all kinds of cloven hoofed animals on the premises are affected; the low percentage of the susceptible animals that succumb; the lameness in the hogs; the "smacking" in cattle; the immunity of horses and mules; the mortality of the sucklings, etc., must be taken into consideration in differentiating this disease. Avoid a public announcement of the presence of this disease until the diagnosis is positive; but take no chances of permitting the spread of the disease through failure to notify the proper authorities in every suspected case. The instructions issued by the Bureau of Animal Industry at Washington on this matter are as follows: "In all cases of foot-and-mouth disease, even where there are only slight grounds for suspicion of a new outbreak, the matter should be reported *immediately by wire* to the Chief of the Bureau; a detailed written report should be forwarded *as soon as possible.* This report should include a description of the lesions and their location, the number of susceptible animals of each species, the number of animals of each species affected, the temperature record, and the history, including the evidence, if any, of contagion." Heed them.

Treatment: This is a subject open to discussion. It has been proved that quarantine and slaughter, except perhaps in very high priced stock, is the only safe and sane method to combat the disease where there is a probability of its eradication. The course of the disease is from ten days to two weeks; it is but slightly fatal, except in some outbreaks where it assumes a malignant form and in young animals, but its effect on weight and milk or wool causes a great economic loss.

It is a quarantinable disease and, as above stated, one should waste no time in notifying the proper authorities of suspected cases. The failure to do this in the 1914 outbreak resulted in the expenditure of five million dollars by the Federal and various state governments, stockyards and railroads in combating this disease and a loss to the live stock industry from quarantines and interference with the marketing of live stock, probably four times as great. Twenty-five millions for neglect of this simple precaution!

6. Tetanus.

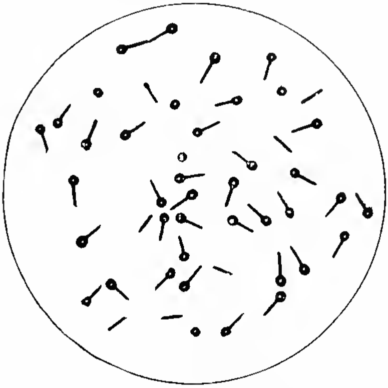
Lockjaw; trismus.

Cause: The *Bacillus tetani,* an anærobic organism. It is a slender, spore-forming germ, and has been called the "pin bacillus," and the "tennis-racket bacillus." It is about one five-thousandth of an inch long, and produces the most powerful toxin known, one three-hundredth part of a grain being sufficient poison to kill a hundred and seventy-five pound man. It forms spores, which remain resistant for years. The bacilli stain readily with carbol-fuchsin and by Gram's method.

The period of incubation is from three to five days, the shorter period being invariably fatal. This may explain the reason why the disease is so deadly to lambs following castration, ear-marking or docking in infected corrals.

The duration of the disease is from three to seven days.

Symptoms: Being a wound-infection disease it usually appears among lambs, after castration, docking, ear-marking or, in rare cases, from umbilical infection. There have been cases where ewes have been infected after labor.



Bacillus Tetani—With Spores in Various Stages of Development.

In young lambs, about a day or so after infection, they become dull, lose their appetite, and as the disease progresses, assume a stiff, "saw-buck" attitude. The muscles in the neck become rigid, causing inability to swallow, and subsequent bloating is noticeable. Sometimes a profuse diarrhea occurs. Death occurs from suffocation.

The disease is quite apt to run a subacute course in lambs infected from castration or docking grounds. They may be unable to put the nose to the ground, to drink from a pail or even to nurse for as much as two weeks and yet retain their ability to swallow milk given as a drench. During most of this time, they may be able to walk without much difficulty, and even to run rather swiftly in a straight line, and yet when down be unable to rise without help. These cases when down lie on the side with the legs extended stiffly, horizontally. In turning when running, they are almost sure to fall. If they fall in the warm sunshine and lie there for a time, a very high temperature up to 108 to 110° Fahrenheit speedily ensues. Recovery is rare.

Once this affection appears in a flock it is apt to affect as high as twenty-five per cent of the lambs having access to the infected quarters after castration or other surgical operations.

Anatomical changes: These are very slight. The history of the case; muscular spasms; rigid body; extended legs, and darkened blood, with no great congestion of any organ, helps one to arrive at a correct diagnosis more than postmortem lesions.

Differential diagnosis: Plant poisoning is accompanied by almost maniacal convulsions, while in tetanus the spasms are only muscular.

Strychnin poisoning is more severe, with some digestive disturbances. The struggles are more intense; the course of the malady more rapid, and death ensues in a very short time.

The cerebral form of hemorrhagic septicemia is accompanied by the characteristic petechiæ.

Gid causes great nervous excitement, but no muscular tremors.

Eclampsia is more of a quiet stupor.

Injuries to the head, such as from a rock rolling down the mountain side and hitting the animal over the brain, cause stupor and coma.

Rabies assumes a more frenzied course, rapidly passing into the paralytic stage.

Convulsions from parasitic invasion are minus the muscular rigidity.

Polyarthritis in lambs may confuse at first, but the attitude will quickly differentiate the latter.

Treatment: After the characteristic symptoms appear among sheep, very little can be done. Since the infection occurs only among flocks having access to a corral, the entire band should be moved to other quarters. Immunization is practical only in high priced animals, and then the outcome is problematical.

7. Rabies.

Hydrophobia; lyssa; mad-dog; canine rage.

This disease has assumed importance in the West due to outbreaks among dogs, coyotes and other predatory animals on the range: Much loss has occurred among sheep from this disease, and the zone of infection is constantly increasing.

Cause: Unknown. The virus is conveyed by the saliva. Negri bodies found in the brain confirm the clinical diagnosis. Remarkable success in diagnosing this disease from a blood examination has been reported recently.

The period of incubation is supposed to be around three or four weeks. In 1903 Negri discovered the bodies found in the brain, which bear his name. While the etiology of these are still obscure, their presence in the brain of a suspected animal is used to confirm the diagnosis.

Often the prompt diagnosis of rabies in animals may save human life, for man can take the Pasteur treatment at once, if bitten, even on the slightest suspicion.

The resistance of the virus is rather great, as saliva from infected animals will remain virulent for over twenty-four hours, and the brain tissue may be virulent for over two weeks. For this reason, when posting animals supposedly dead from the disease, the greatest of care should be used, and rubber gloves worn. A saturated solution of boric acid will kill the virus in fifteen minutes; a 1 per cent solution of potassium permanganate in twenty minutes, and a 3 per cent solution of carbolic acid in one hour. Acetic acid (as vinegar), lemon juice or soda solutions will disinfect quicker than the strong mineral acids.

Perhaps around 75 per cent of people bitten or otherwise exposed to the virus, fail to contract the disease, but one cannot be too careful with this treacherous and fatal malady.

Symptoms: In sheep, the period of incubation is unknown; there are practically no prodromal symptoms. In ewes, stamping the feet and a desire to butt everything in sight is noticeable. In bucks, the sexual desire is greatly increased. This stage of disease persists for nearly a week, and the animal finally drops to the ground from exhaustion and dies from paralysis.

The diagnosis can usually be made from the history of the case, together with the characteristic symptoms of the affected animals. Poisoning is often confused with this ailment by the herders, and in every doubtful case a microscopical examination of the brain should be made, as autopsy reveals little or nothing.

Differential diagnosis: *Gid* differs in causing the animal to turn rapidly around in a circle, with no progress into the maniacal and paralytic stages.

Plant poisonings are accompanied by convulsions; rapid course, and digestive disturbances.

Tetanus is to be differentiated by the quiet, intense "sawbuck" attitude, and muscular spasms.

The history of the case, followed by bacteriological findings of the Negri bodies, helps one to arrive at a correct conclusion better than postmortem lesions.

Treatment: Infected animals should be destroyed and the carcasses burned. Extra precautions should be observed in watching the actions of the sheep dogs. The Pasteur treatment should immediately be administered to any person bitten by even a suspicious-acting dog. The expense of the Pasteur treatment is too great to be practical for ordinary sheep, although valuable ones may be given the treatment. Zell has reported a successful, inexpensive prophylactic treatment that he has used to some extent in an experimental way. It consists of an intravenous injection of rabbit virus. One injection is sufficient.

Pasteur's preventive treatment is an extremely efficient prophylactic measure, and the technic of preparing the vaccine is as follows:

The spinal cord of a rabbit dead from the disease is cut into small pieces, to threads, and suspended in bottles. containing about half an inch of caustic potash in the bottom. Wool or cotton plugs are used for corks. These are kept in a constant temperature until the spinal cord has shriveled into a very small piece of tissue. This is mixed with saline solution and injected at certain periods, the most attenuated virus being injected first.

A more recent improvement is the Högyes method, using a spinal cord from a rabbit dead from rabies. The doses are made up of different strengths of the rabid material in saline solutions. The dilutions run from 1 to 5,000. 1 to 2,000, 1 to 500, 1 to 200, and 1 to 10, the first or weakest concentration being used first.

8. Foot-Rot.

Lip-and-leg ulceration; contagious pustular dermatitis.

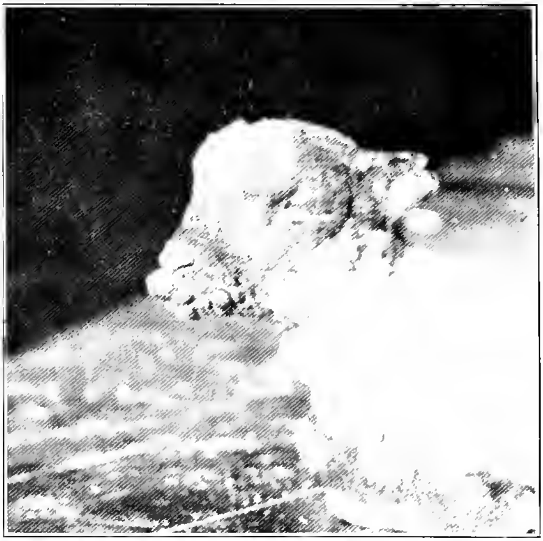
Two forms of foot-rot are recognized on the western range.

One is non-contagious, and is due entirely to wet weather and standing in mud which softens the hoof and produces a condition practically the same as scratches in horses.

The second type of foot-rot is caused by the Bacillus necrophorus, which, when affecting the mouth at the same time, is called "lip-and-leg ulceration," and in some stages might be mistaken for foot-and-mouth disease by the inexperienced.

The Bacillus necrophorus is an anærobe, usually found in chains. To secure pure cultures, rabbits are inoculated subcutaneously. The period of incubation is unknown, but is probably around one week.

Symptoms: The contagious form exhibits very marked symptoms. The affected sheep limps; swollen areas are found around the coronary band, with a separation of the hoof, and little gangrenous spots having a very putrid odor occur around the interdigital canal; sometimes the infection extends to the eyes and nose and, in females, to the genital organs.



Lip-and-Lef Ulceration, Showing Lip Lesions.

Duration of the disease varies from ten days to a month.

The mortality is not great, but the economic loss is heavy, both in weight and wool.

Differential diagnosis: Foot-and-mouth disease is accompanied by excessive salivation.

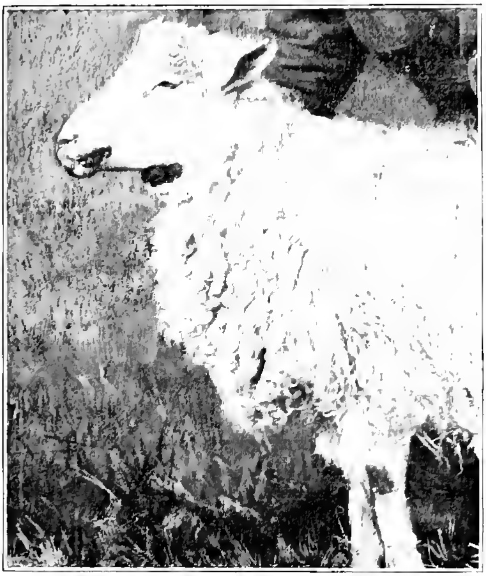
Closure of the small gland between the claws often causes intense painful swelling, but no odor.

Lip Ulceration in Feed-Lot Lambs.

Ordinary foot-rot caused by filth, dampness and streptococcic invasions, soon responds to hygienic care and simple treatment. Lip-and-leg ulceration, on the contrary, often proves stubborn.

Treatment: As the germ grows best in oxygen-free tissue, the first thing to do, is to remove all scabs that keep out the air. The diseased parts then can be carefully touched with a solution composed of one part pure nitric acid to seven parts water. After the germs have been destroyed, a healing ointment composed of mutton tallow, two pounds; sulphur, two ounces; Balsam Peru, two ounces; and carbolic acid, two drams. This can be applied once daily.

If the copper sulphate dip does not prove strong enough, five pounds carbolic acid to twenty gallons water, can be used. Lime can be thrown around the corrals, which should be kept dry.



Lip-and-Leg Ulceration.

In treating contagious foot-rot or lip-and-leg ulceration, the outbreak should be reported to the nearest state or Federal official, as it is a quarantinable disease. However, one should show judgment in this, as nothing makes the average sheep owner more incensed than to be quarantined with a few cases of simple non-contagious foot-rot in his band.

9. Ovine Caseous Lymphadenitis.

Psuedo-tuberculosis; pseudo broncho-pneumonia.

This is a disease rapidly spreading among sheep, usually occurring in animals over two years of age. It is also prevalent in Argentine, Europe and Australia.

Cause: The *Bacterium pseudo-tuberculosis ovis,* a very delicate, non-spore-forming, rod-shaped germ. It stains by Gram's method and with the anilin dyes. It grows in agar, and is pathogenic to guinea pigs and mice.

Symptoms: There are no marked symptoms, and the disease is not discovered until after death. Many cases are reported by government inspectors at packing houses; the malady seems widespread throughout the West.

The lymphatic glands become caseous, and in individuals where great enlargement has taken place, emaciation is present.

The chief anatomical changes are found in the lymphatic glands, particularly in the precrural, prescapular, bronchial, mediastinal and scrotal. The mesenteries are not so commonly invaded. When first infected the gland becomes enlarged, then follow centers of necrotic degeneration, filled with a greenish purulent fluid. Later, the whole gland may become calcareous. The liver frequently contains cheesy nodules of a greenish consistency, while the remaining organs may be more or less affected, depending on the length of time the animal has had the disease.

Differential diagnosis: This is very hard to differentiate from true tuberculosis or Johne's disease, except by a bacteriological examination, and hence it is becoming very prevalent in sheep.

Nodular disease is characterized by the intestinal lesions.

Treatment: Nothing but prevention is known at the present time.

10. Tuberculosis.

Pearly disease; consumption; grapes; "white plague." Very rare in sheep.

Cause: The Bacterium tuberculosis, a very small organism found chiefly in the lymph system. Because of the very extensive literature on this subject only a brief summary is herewith given.

The Bacterium is a very minute organism, being about one twelve-thousandth of an inch long, and one fifty-thousandth of an inch wide. It is stained with anilin dyes, and is non-spore-producing. For bacteriological work, usually guinea pigs are inoculated with the infected material, and the cultures made from them.

Symptoms: A tuberculous sheep exhibits very few symptoms; lack of thrift being the most noticeable. The visible mucous membranes are pale, while the wool is harsh and dry. The clinical picture greatly resembles infection by stomach worms, and only an autopsy will determine the exact trouble. In suspected cases the intradermal tuberculin test may be resorted to.

Differential diagnosis: Only a very careful microscopical examination can differentiate true tuberculosis from Johne's disease and from ovine caseous lymphadenitis (pseudo-tuberculosis).

Nodular disease, caused by the minute parasite, the *esophagostomum columbianum,* attacks the intestines. This is very commonly found in sheep, while tuberculosis is not.

Treatment: At present, hopeless. An entire change of quarters and breeding stock is advised.

11. Septicemia.

Sepsis; pyemia; blood poisoning; putrid fever; puerperal fever.

Septicemia is a general term, embracing a number of specific conditions, and caused by wound-infection.

In septicemia are found no localized lesions, but general changes.

In pyemia, local formations of pus organisms take place. For general purposes, this is a very fine distinction, and the clinical term, "blood poison" conveys to the owner just what is meant.

Cause: The pyogenic bacteria and bacillus coli communis. The micrococcus is scarcely one twenty-five-thousandth of an inch in diameter, and the staphylcoccus and streptococcus measure from one six-thousandth to one twelve-thousandth of an inch in length. These germs are very common, being found almost everywhere, and only natural resistance keeps infection to the circumscribed bounds.

Symptoms: Three types of septicemia are seen:

1. Bacterial, or bacteremia, caused by the pus bacilli and

coli communis. Many other pathogenic organisms come under this heading, such as anthrax, blackleg, hemorrhagic septicemia and malignant edema.

The symptoms greatly depend on the site of invasion, but in general there is a high fever; great depression; and a rapid, weak pulse. There is loss of appetite, sweating, paralysis, with cyanotic mucous membranes. Later, diarrhea may set in, followed by coma or convulsions and death.

2. Septic intoxication or poisoning. This type is caused by the absorption of poisons, toxins, ptomaines, or may be due to putrefactive changes. The source of these may be located in the skin, as from maggots; in the lungs, from pneumonia; in the uterus, from retained placenta, or they may be ingested with the food.

When non-pathogenic bacteria of the putrefactive type develop toxic products by decomposition of the animal tissues, the condition is known as "sapremia".

The symptoms, as in the first type, depend greatly on the location and kind of lesions.

3. Mixed infection, or a combination of the first and second. This is sometimes called pyo-septicemia, and may result from careless castration, docking, or animal bites, combined with filth.

Anatomical changes are noted in the tar-like consistency of the blood, with general decomposition of the affected tissues. The subject of septicemia is of more importance to the meat inspector than to the clinician, because treatment in the great majority of cases is hopeless from the very beginning.

Differential diagnosis: Septicemia being a wound-infection disease, subdivided into many specific maladies, such as septic metritis in ewes, or navel-ill in lambs, is easily diagnosed as such.

The greatest importance in dealing with these types of disease, is to differentiate the highly contagious from the infectious or sporadic wound-infections.

Treatment: The treatment should be applied to each specific disease, such as navel-ill in lamb (page 175) or septic metritis in the ewe (page 187) which see.

In general, the use of bacterins, serums, surgical methods, with antiseptics, blood tonics and hygenic care is indicated.

The carcass should be condemned, and burned. Digging a shallow cross-shaped trench, putting in a few old rails, sticks or the like, pouring a gallon of coal oil over the carcass, soon incinerates it enough so that it loses its dangerous properties. Burying a carcass is not as good as burning, and leaving the dead animals lying around to be devoured by predatory animals, is criminal negligence.

12. Contagious Abortion.

Another disease seldom found in sheep. Usually the form of abortion occurring among ewes is due to toxic ingredients found in the food, or to exposure and bruises. However the possibility of an enormous increase in the prevalence of contagious abortion in sheep, such as has occurred recently among swine, should not be overlooked.

13. Actinomycosis.

Lumpy jaw; big jaw; wooden tongue.

Cause: Actinomyces bovis, or ray fungus. Also known as the cladothrix actinomyces. The fungus appears in small rosettes, of a peculiar yellow color, and stains with the anilin dyes.

The period of incubation is not known.

Symptoms: Inability to chew food is the first symptom noted, followed by a swelling on the jaw. The tongue may be affected, and the animal succumb to starvation. It is a very rare disease in sheep, but cases are on record.

Differential diagnosis: Tuberculosis is not accompanied by the characteristic yellow, cheesy lesions found in lumpy jaw.

Supernumerary molars or decayed teeth may simulate lumpy jaw; the odor, however, is pathognomic.

Abscesses caused by maggots may resemble slightly the lesions of lumpy jaw, until the offending parasites are found.

Treatment: None practical on the ranges. Slaughter under government inspection is perhaps the best method. Where but a single, or at most but a few individuals are affected on a small farm the administration of potassium iodid may be resorted to.

14. Glanders.

Sheep have never been known to become infected through natural sources. This disease was formerly confused with hemorrhagic septicemia.

15. Sheep Pox.

Variola ovina; pox.

This is an acute infectious disease of sheep, often becoming epizootic. It attacks the wool-denuded portions of the body, causing a small eruption or "pimple." It is extremely contagious, and sometimes assumes a very fatal type, especially at the onset of the outbreak. It is prevalent in Great Britain, Europe, Asia and Africa.

Cause: Unknown. The purulent matter found in the pustules seems to convey the infection. The exact method of transmission is unknown, and the period of incubation is about one week.

Symptoms: The prodromal symptoms, in general, are very noticeable. Loss of appetite; high temperature, and, later on in a few days, the appearance of small papules on the bare or hairy portions of the skin. These become covered with little scabs, and turn to a yellowish color, with flat tops. The disease is not commonly fatal, but the irritation causes a great loss of weight and wool. So far, it has not made its appearance in this country, although variola is a prevalent disease in other domesticated animals.

Three types may be seen:

1. The regular form, in which the disease runs a consistent, benign course. High temperature, loss of appetite, and great depression is found. These are followed by arching of the back, labored respirations, injected conjunctiva, with a nasal discharge. There is great congestion in the visible skin, and in several days after the first symptoms are noted, small, red spots are seen in the axilla, inner aspect of the thigh, and around the face, nostrils and lips. About a day later, these rise up into rounded papules, with flat summits. Several days later these change into pustules, the crowns of which are yellow, with purulent contents. In from three to six days, the pustules become encrusted with flakes of dried epidermis, and drop off, leaving the well known "pock marks" on the surface of the skin. The duration of the disease in this form is about three weeks, and from five to ten per hundred succumb.

2. Malignant form, in which the pustules run together, making a mass of infected epidermis full of purulent matter, and

often leading to gangrene. With this form comes drooling at the mouth, cough, diarrhea, and even swelling of the head, resembling purpura in the horse. The duration of this type is often a month, and many more weeks pass before the animal is completely well. Blindness, lameness or permanent weakness in some part may be the sequelae, and the mortality runs from 30 to 80 per hundred.

3. Variola hemorrhagica, in which small hemorrhages occur in the skin with the vesicles. Gangrene sometimes occurs, with a severe hematuria. The mortality is somewhat lower than in the malignant type.

Differential Diagnosis: Scab may be differentiated by the extreme irritation in woolly parts of the body, patches of which fall out, and by the presence of mites.

Blue tongue is found only in south Africa at the present time, and comes minus the red papules.

Eczema assumes more of a chronic, non-purulent course.

Foot-and-mouth disease attacks the mouth, feet and genital organs, while other wool-denuded portions of the body are apparently normal.

Urticaria, or nettle rash, is easily distinguished by the edema of the skin, with no signs of papules or vesicles.

Hemorrhagic septicemia may be differentiated from the hemorrhagic form of variola by the absence of pustules.

Treatment: As one attack confers immunity, light outbreaks are welcomed in the countries where the disease is established. Immunization is practiced by taking lymph from sheep suffering from the regular form in a very benign course. The lymph should be perfectly clear and free from turbidity, or serious infections may result. It is best when the eruptions are from six to eight days old. The site of inoculation may be on the inner surface of the ear, or on the under surface of the tail, similar to the intradermal test in cattle. A rather heavy needle can be used to slightly scratch the skin, after which the lymph is applied. The needle should be sterile when used. In about ten days if the vaccination "takes," the pustules are ripe. Within ten days all lacking these pustules should be inoculated again.

Medicinal treatment is not practical, although inunctions of glycerin will do as much good as anything in valuable animals.

Occurring in the lambing season, it may prove disastrous, and the economic loss in any outbreak is always heavy.

Strict quarantine to prevent its introduction to our shores is the only practical line of treatment.

16. Braxy.

Bradsot; gastromycosis ovis; "black disease"; "white water"; and "quick sickness."

This is a disease much resembling blackleg, and recent investigations have shown that the two possess many identical features. It is very destructive to sheep in the Scandinavian peninsula, Iceland, Denmark, Germany, Scotland and the western coast of England.

A peculiar trait of the disease is that it appears only from October to January, and, like blackleg, affects certain pastures for years. In many districts over half the sheep are affected, with a high mortality. Suckling lambs, or sheep over two years of age, seem to be immune.

Cause: Not definitely determined, but the gastromycosis ovis is believed to be the exciting organism. This greatly resembles the bacillus of blackleg, being a short, thick, anaerobic germ, about one ten-thousandth of an inch in length, and one twenty-thousandth of an inch in width. Unlike the bacillus of blackleg, it has been found to be pathogenic to swine and mice.

Symptoms: Very similar to blackleg. The victim becomes listless; loses its appetite, and has a very high temperature. In the peracute or apoplectic type, the animal may suddenly fall down and expire within a few hours, or even sooner. An almost fatal symptom is the appearance of a profuse diarrhea, accompanied by convulsions.

The period of incubation is not known, neither is the exact course of the disease. In the affected districts it is said trained dogs will trail a sheep about to die with the disease, giving the shepherd warning of its appearance.

The anatomical changes are chiefly found in the peritoneal fluids, which are whitish in color or opaque. The abomasum is greatly congested and may contain a quantity of a sero-sanguineous mucus. The spleen is very soft, while the kidneys are friable and injected. The carcass, as in blackleg, soon begins to putrefy, and becomes full of gas.

Differential diagnosis: Future experiments may determine definitely the relationship between braxy and blackleg in sheep, or whether they are one disease.

Anthrax causes the typical "blackberry" spleen, and affects all domesticated animals.

Malignant edema must be differentiated by a bacteriological examination and from the history.

Louping-ill by the absence of the gastromycosis ovis.

Poisoning by the absence of high temperature and the more normal peritoneal fluids.

Treatment: Inoculation with vaccines either prepared from the peritoneal fluids or dried kidney, has given excellent results. In many localities affected by the disease, antiseptics, such as copper sulphate, carbolic acid, iron sulphate or magnesium sulphate, are used. Bleeding from facial veins is often resorted to by shepherds, with varying success.

Prevention by keeping sheep off of known infected pastures is the only practical line of treatment for the average flocks.

17. Scrapie.

This is a disease long known in England, whose etiology, like that of louping-ill, is still very obscure.

Cause: Unknown, although organisms similar to those of Johne's disease or the tuberculosis type have been found in the intestines. Some claim it is an infestation of sarcosporidia.

Symptoms: The affected animal acts wild, as though pursued by dogs, and rubs against trees or posts. There is great irritation of the skin, although no lesions can be detected.

The first stage, lasting about three weeks, shows rather intermittent symptoms. Otherwise the animal appears normal.

The second stage of about the same duration as the first, is more severe. The animal appears nervous and frequently defecates.

The third phase exhibits more pronounced symptoms. There is great irritation of the skin, rapid emaciation, paralysis, and convulsions before death.

The whole duration of the disease is from two to four months.

Differential diagnosis: Experienced veterinarians easily distinguish scrapie from rabies, tuberculosis, poisoning, sheep pox, scab or poisoning, by the history of the case, and the known affected localities.

Treatment: None satisfactory at the present time. Immediate slaughter, burning of manure and litter if practical, and removal to other pastures is the best method of control.

18. Carceag.

Paraplasmosis; ictero-hematuria.

A disease not found in this country, but existing principally in the Balkans along the Danube river. It is somewhate similar to the louping-ill of England.

Cause: Believed to be the piroplasmosis ovis, resembling in shape the causative factor of Texas fever in cattle. These are found in the red corpuscles.

Symptoms: High temperature; loss of appetite and bloody urine. Some cases of an ictero-hematuria have been found in this country, but no piroplasma were isolated and dipping eradicated the trouble.

Differential Diagnosis: True carceag can be determined by finding the protozoa in the red corpuscles.

Hematuria may occur from a variety of causes, usually from some digestive trouble or parasitic invasion.

Treatment: None. Wholly preventive.

19. Johne's Disease.

This disease is a very close relative of tuberculosis, and is found in various parts of the world, but so far, none has been identified in sheep in this country.

Cause: Believed to be a very minute acid-fast organism, greatly resembling the bacterium of tuberculosis.

Symptoms: Very similar to the chronic type of tuberculosis in cattle. Gradual emaciation, voracious appetite, with more or less diarrhea, are three prominent symptoms.

Differential diagnosis: Tuberculosis can be differentiated only by a very careful bacteriological examination.

Dysentery from any cause may be diagnosed more from the history of the case than from postmortem findings.

Treatment: None practical at present. Isolation and immediate slaughter of all infected animals, and burning of all available litter to destroy the bacteria, is the best course, followed by removal to fresh pastures.

20. Rinderpest.

While this is commonly a disease of cattle, and not found in this country at the present time, it has caused immense losses in various parts of the world. Southern Europe, Asia, the Philippines and Africa have been devastated time after time with this deadly malady. In some instances, large losses of sheep have occurred.

This disease became such a widespread epizootic that the first veterinary colleges were established to combat this malady alone.

Cause: Unknown. The exact methods of transmission have not been definitely settled, although it is believed such intermediate carriers as flies, birds or dogs may carry the virus. It is rather easily destroyed by disinfectants.

Symptoms: A high temperature, up to 108° F. usually ushers in the attack. The pulse is rapid, and there is great depression, with loss of appetite. The victim may shiver as in pneumonia, and when the disease comes on in its full intensity, the visible mucous membranes assume a scarlet hue.

In severe cases, the animal becomes so weakened that it cannot rise. There is a frothy, bloody exudate from the nostrils, mouth and anus, while the temperature falls to subnormal, and convulsions take place, followed by death.

The duration of the disease is from five days to a week. Usually, the infection is more virulent at the onset of the disease, and toward the end of the epizootic, many animals may recover.

Sheep usually exhibit pulmonary symptoms, and experienced veterinarians declare it greatly resembles hemorrhagic septicemia.

Differential Diagnosis: The greatest difficulty in diagnosing the disease is at the outset of a severe epizootic in a newly infected country. Should it gain entrance to our country, it might become widespread before being identified, consequently the greatest caution should be used in investigating diseases of an epizootic character, and no time should be lost in notifying the proper authorities.

Hemorrhagic septicemia contains the well known bipolaris bacillus.

Foot-and-mouth disease is characterized by the peculiar eruptions on the buccal membranes, and the frequent involvement of the genital organs.

Anthrax is accompanied by the tell-tale "blackberry" spleen, and the attacking of all domestic animals, including man.

Sheep pox is more benign, runs a longer course, followed by the characteristic papules.

Blue tongue, or South African malarial fever, may be differentiated by the mouth lesions.

Poisoning is noted by the absence of abnormal temperature.

Dysentery is marked by the earlier appearance of diarrhea, and an absence of mouth lesions.

Sometimes, as in hemorrhagic septicemia in this country, there is a mixed infection, in which some piroplasma may be found. This greatly complicates the diagnosis, and much experience with rinderpest and other oriental scourges is necessary to arrive at an accurate conclusion.

Treatment: Quarantine and immediate slaughter is the only practical line of treatment to combat rinderpest, for once it gains a foothold, it is one of the greatest pests known.

In Russia, animal inoculation of cattle was tried by the following method: A sterile sponge was introduced into the nostril of an affected animal, and allowed to become saturated with the secretions. The contents were then squeezed into a glass, which was immediately covered, and a drop of this material subcutaneously injected into the neck. However, this method has fallen into disrepute, as nations have found complete eradication the only practical method to combat the disease.

In India, serum from blood of recovered cattle is used, and is giving good results in this species of animal.

With the seven seas open for the commerce of the world, wide dissemination of disease will be more prevalent than ever. The pandemic of human influenza recently sweeping over the globe has brought this phase of preventive medicine more and more to the front. With such animal scourges as rinderpest, pleuropneumonia and foot-and-mouth disease only kept from our shores by constant vigilance, strict quarantines become absolutely necessary. Only by these can the fabric of our entire agricultural industry be kept intact.

21. Blue Tongue.

Malarial catarrhal fever; "fever."

A South African disease of sheep found extensively in Natal, Transvaal and Rhodesia. It appears to be more severe and prevalent in warm, wet weather, hence the term, "malarial fever."

Cause: Unknown, but the virus seems to be in the blood, and retains its virulence for months. The period of incubation is about four days.

Symptoms: The victim appears dull and listless, with a lack of appetite. The temperature will be high, running around 108° F. In about seven days eruptions appear in the mouth and lips, while the visible mucous membranes of the buccal cavity become blue in color. There may be frothing from the mouth, due to the pain, and a slight discharge from the nostrils. The dental pad becomes swollen, and, in normal cases remains in this condition for two or three days. The membranes become loosened and are worn away by eating, and recovery soon takes place.

In severe cases, however, the inflammatory zone includes the tongue, hard palate, cheeks and gums. The tongue becomes gangrenous and of a dark blue color. A portion of it may slough off. If diarrhea sets in, it is usually considered a fatal sign. In some cases the feet become involved, and the alimentary tract exhibits symptoms of enteritis. The spleen in these cases is greatly enlarged, and of a soft consistency; the kidneys may be infected.

The mortality runs from 5 to 40 per cent, the latter occurring in the severe types. Like foot-and-mouth disease, the economic loss is very great, due to emaciation and decrease in wool production.

Differential diagnosis: Foot-and-mouth disease shows the characteristic lesions in the mouth, feet, and often in the genital organs.

Foot-rot is characterized by a peculiar necrotic appearance, and usually the tongue is unaffected.

Rinderpest runs a more severe course, with greater pulmonary symptoms.

In countries where the disease is a constant visitor, the history and experience in detecting the infection is of the greatest service.

Treatment: None, except along lines of hygienic care. Where the victims have become weakened from persistent oral sores, gruels, raw eggs and nutritious food may be given with care so as not to cause traumatic pneumonia.

Shelter, abundant feed and pure water afford the best after-treatment.

Inoculation has been tried, but dipping seems to be more satisfactory. Individual treatment in sheep is usually too expensive except in valuable breeding animals.

22. Louping-ill.

Mad staggers; trembles; chorea paralytica ovis; twitch; dizzy; shivers; meningo-myelitis.

This disease is not found in this country, but is prevalent in Great Britain. It makes its appearance in the early spring, from February to April, and nearly half the exposed sheep contract it, with a mortality of 95 per cent.

Cause: Believed to be the Bacillus chorea paralytica ovis. This organism is often found in chains, and inhabits the peritoneal fluids.

Symptoms: Two types of the disease are found:

1. Acute, in which the affected animal leaps wildly into the air, and when quieter, walks as though blind. There is some fever, although not high, ranging from 105° to 106° F. Respirations are labored, and toward the last convulsions take place. The animal lies on one side, with head and limbs rigid, as in tetanus or strychnin poisoning. Death intervenes in from 24 to 36 hours, and the entire duration of this type is from two to three days.

The chief anatomical changes are found in the peritoneal fluids, which are opaque or greyish in color. Bloody exudates ooze from the mouth, nostrils and anus, and the mucous membranes of these parts may be of a purplish color. Putrefaction sets in soon after death, but the wool retains its hard pulling qualities, and the skin does not change much the first twenty-four hours.

2. Chronic, in which the nerve symptoms predominate. The front legs are carried high as though wading in deep water. The head may be carried to one side or extended. The eyes are dilated, with a frenzied gaze. Loss of control of the hind legs

is now apparent, and trembling of the muscles takes place. The temperature is normal.

The course of this type is rather constant, and of from two or three weeks' duration. The victim finally dies from starvation and exhaustion.

No characteristic lesions are found, except the spinal cord appears to contain small hemorrhagic spots, and the peritoneal fluids are opaque.

Differential diagnosis: Tetanus is differentiated usually by following some wound infection, such as docking, castration, or animal bites. Tetanus is also more sporadic.

Gid is characterized by brain lesions.

Blackleg and braxy by the gas formation after death.

Rabies by the peculiar "bunting" tactics of affected sheep.

Poisoning by the history, and from the intestinal contents and lesions.

Also, sheep dying in localities known to be infected, give a clue to an accurate diagnosis.

Treatment: Prevention by avoiding infected pastures is the best method of control. Inoculation has been tried with success, but immediate slaughter and isolation is the correct line of treatment. No medicinal agents have been found satisfactory.

23. Heartwater.

A South African disease affecting sheep, resembling our Texas fever in that it is transmitted by a tick. Formerly it was a very serious menace to the sheep industry in South Africa, but dipping has proved an efficient means of control.

Cause: An ultramicroscopic virus, carried by the Bont tick. The life cycle of this tick is completed in about nine months, and the period of incubation after tick infestation is about two weeks.

Symptoms: A high temperature ushers in the attack, followed by gradual weakness, complete exhaustion and death. There is little loss of appetite, and diarrhea is considered a fatal sign. Extreme tympany is present toward the end of the disease. The course of the malady is rapid, and the loss about fifty per cent of affected animals.

Treatment: Eradication of the tick by dipping with arsenical preparations, burning the grass in the autumn, and avoiding tick-infested ranges for at least fourteen months, has been found the only practical method of control.

24. Mediterranean Fever.

Malta fever; rock fever.

While this is principally a disease affecting goats, cases have been recorded as found in French sheep.

Cause: The Micrococcus melitensis, a round organism about one-eight-thousandth of an inch in diameter.

Symptoms: The organisms being found in the blood stream the symptoms are of a chronic septicemic type. The principal channel of infection is through milk.

Treatment: None.

CHAPTER VII.

DISEASES OF THE BLOOD.

1. Anemia.

Acute anemia may be caused by some form of traumatism, such as may result in a severed blood-vessel; or it may be caused by epistaxis or phlebotomy.

Chronic anemia is usually the result of internal parasites, such as stomach worms; external parasites, as the scab mites, or the ingestion of large quantities of marshy, watery food. Extensive feeding of beets, turnips or other foods deficient in proteids may cause this condition.

Anemia is primarily a symptom of some disorder.

Symptoms: The manifestations of this ailment are very pronounced in sheep. The skin, instead of being of a pinkish hue, is a paper-like white. Later, the animal becomes dull, loses its appetite, becomes weak, is not able to stand up, and death from suffocation ends the clinical picture.

Treatment: This consists in removing the exciting cause, be it parasites, exposure, or lack of exercise, and supplying good nourishing food. Some form of iron should be fed the affected animals *ad lib.*

2. Red Water.

Sanguineous ascites.

This ailment is due to feeding frosty turnips or other watery roots that have been frozen.

Symptoms: In the morning, upon going out to feed the animals, several sheep will be found to have no appetite. The breathing will be labored, and considerable bloat is present. A swelling is often noticed under the lower jaw and the under side of the neck. Constipation is followed by a profuse diarrhea. The clinical picture greatly resembles poisoning.

Treatment: The chances for recovery depend on how long the disorder has been present. If the animal is anemic, young and delicate, the prospects for successful treatment are not good.

A complete change of quarters, food and water is recommended. The following may be tried:

℞

Fer. chlorid	ʒi
Olei lini q. s. ad	℥viii

M. Sig. Give tablespoonful once daily.

3. Pining.

This disease is not found in this country. It occurs in England, where many plants are found to have a tendency to constipate. The onset of this disease is very insidious; it runs a course of from a week to a month and ends fatally.

Symptoms: The wool becomes harsh; the eyes dull; the mucous membranes pale, and toward the end the sheep lies down a great deal. Finally it becomes too weak to get up, and dies from inanition.

Treatment: The only treatment known to be of value is a change of range, to prevent an extension of the disease. It is possible also that animals in incipient stages of the disease may be saved by this means.

4. Malnutrition.

Debility; emaciation; exposure; weakness; exhaustion.

On the range in nearly every band will be found one or more "weak sisters." These remain poor and unthrifty in spite of all care or treatment. Culling these out and sending to market is the western method.

In small farm flocks where this is inadvisable, the greatest care will be needed to determine the exciting cause. If the case is hopeless, an unfavorable prognosis will prove the best line of treatment in the end. Oftentimes, parasites of a rare or obscure nature may be present, or a chronic catarrh of the mucous membrane of the intestines, preventing assimilation of food.

5. Anorexia.

Loss of appetite.

This is merely a symptom of disease, lack of exercise, overfeeding, spoiled food, or extreme fright.

The treatment is symptomatic.

6. Depraved Appetite.

Pica.

This is often seen in pregnant ewes. They will refuse good food in order to eat sour, moldy forage. Any salt lick containing mineral salts, carrots, or silage is recommended.

7. Leukemia.

This condition is accompanied by a large increase in the leucocytes or white corpuscles with a corresponding decrease in the red corpuscles. The laboratory of the Bureau of Animal Industry at Chicago reports occasional cases as occurring among sheep.

8. Hemorrhage.

Bleeding.

Sometimes seen as a sequela to docking, castrating or injuries.

If possible apply a tourniquet, or ligate the vessel; although the latter is very difficult in sheep. Pledgets of cotton soaked in ferric chlorid or any of the astringents, such as adrenalin, alum, tannic acid, or clean earth may be applied until coagulation takes place. Atropin given internally may assist nature to control the hemorrhage.

9. Thrombosis.

Usually seen in pregnant ewes, and the common time is winter.

The chief symptom is paralysis, with the animal in apparently good health otherwise. It eats, drinks and appears bright.

Good nursing, hygienic care and five-grain doses of potassium iodid several times daily for at least a week are indicated.

10. Debility.

A sequela of anemia, and of various acute diseases.

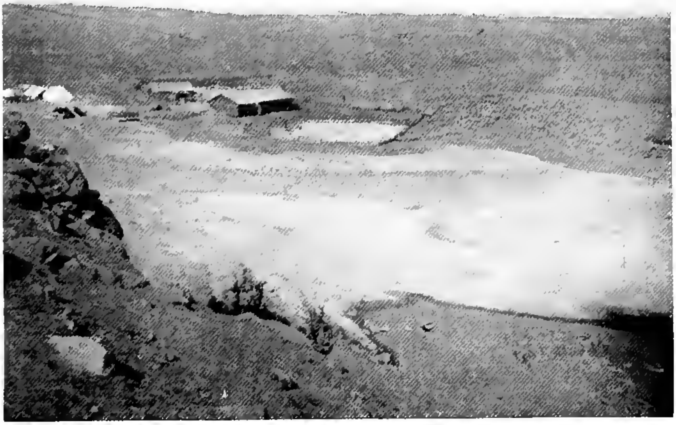
Hygienic quarters and good nursing are the principal requirements, together with removal of the cause. Too many stock owners overlook this important question, and many animals "die getting well."

CHAPTER VIII.

DISEASES OF METABOLISM.

1. Obesity.

This is a rather rare disease among sheep; always secondary to some other trouble. Cases of non-pathological obesity will be eagerly purchased by the butcher.



A Visit to the Sheep Ranch Frequently Leads the Practitioner Far from the Beaten Path, Over Unsurveyed Roads, Through Isolated regions.

2. Rachitis.

Rickets.

This disease is due to a deficiency of lime salts, occurring almost exclusively among lambs.

Symptoms: The animal becomes delicate and does not thrive.

The legs become crooked and pliable, and the "bow-legs" in front are very noticeable.

Treatment: Supply the necessary bone-building mineral salts. The following is excellent for lambs:

℞
Syr. lactophosphate..℥viii
Cod-liver oil ....℥xvi
M. Sig. One ounce daily with dose syringe.

If the patient is a suckling, the ewe can be given lime-containing foods and calcium phosphate mixed with molasses and given as an electuary.

3. Wool Eating.

This is more of a habit among sheep than a disease. Usually when a band of sheep are kept in close quarters, one or two may become warm and itchy and bite their wool. This leads to more biting and others imitate it. A few animals may die from ingesting too much wool, which forms balls in their intestines, causing an obstruction. Others seem not to be affected in any way whatever.

Treatment: This consists in removing the wool-eaters from the rest of the flock, and giving each one a hypodermic injection of one-tenth grain apomorphin once daily for three or four days.

4. Diabetes.

This is a very rare affection of sheep; the cause is not known. It has been classed variously as a disease of the kidneys, liver and of the blood.

Diabetes insipidus is a condition whereby large quantities of urine, with no excess of sugar, are voided.

Diabetes mellitus indicates that large quantities of sugar are being passed.

Treatment: Slaughter under government supervision, with a change of diet for the apparently healthy members of the flock.

CHAPTER IX.

DISEASES OF THE URINARY ORGANS.

1. Hematuria.

Red corpuscles in the urine, causing the latter to assume a reddish color, is a condition often following the ingestion of frozen or poisonous forage, severe injuries to the abdomen, and renal calculi.

Treatment: Is purely symptomatic. Clean food, with hygienic care, usually prevents the trouble from extending to other members of the band.

Medicinal treatment can be instituted by using either of these:

℞
Liq. Fer. et ammon. acetatis..................................℥i
Sig. One-half teaspoonful in a little water three times daily.

℞
Tr. iodi..ʒii
Sig. Twenty drops in water several times daily, or given in drinking water.

2. Uremia.

Uremia is a condition in which the solid constituents of the urine are retained in the blood circulation.

The exciting cause may be a retention of the urine in the bladder, caused by urinary calculi, or a paralysis of the latter, due to some form of poisoning.

Symptoms: It is very difficult to differentiate from poisoning or abdominal injuries, until one can detect urinous respiration. After a period of intense pain, stupor and paralysis ensue and the animal dies in a comatose condition.

Treatment: There is no successful treatment, and immediate slaughter should be advised.

3. Nephritis.

Inflammation of the kidneys; renal inflammation.

This is a secondary condition, following the invasion of parasites; infectious diseases; injuries; exposure to cold and rain, and poisonings.

The symptoms are mainly associated with the primary disorder, and as urinary analyses are impractical in routine work with sheep, very little can be done.

The treatment is symptomatic and not very successful.

The following may be tried:

℞
Pot. iodi..............................ʒiv
M. f. pulvis No. XX.
Sig. One powder dissolved in water and given in feed or as a drench three times daily.

Or the following:

℞
Flxt. uvae ursi.... ....℥i
Sig. One teaspoonful three times daily, in water.

4. Rare and Unimportant Diseases of the Urinary Organs.

Occasionally diseases of the urinary tract other than those mentioned in the foregoing are found in sheep. Usually they are not recognized until after death. Among these may be mentioned cystic kidneys, renal calculi, cystitis, and tape worm cysts —the Echinococcus polymorphus.

CHAPTER X.

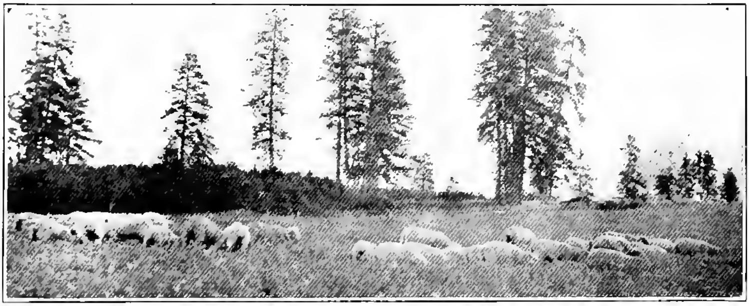
DISEASES OF THE CIRCULATORY ORGANS.

1. Pericarditis.

Due to the fact that the sheep is such a dainty eater we find no traumatic pericarditis such as occurs in the bovine. Other forms are almost unknown.

2. Dropsy of the Pericardium.

When this occurs it is usually a secondary affection due to poisonings, parasites in the liver, or chronic inflammation of the kidneys.



SHEEP FEEDING ON A MOUNTAIN SLOPE, 8,000 FEET ABOVE THE SEA LEVEL.

3. Hypertrophy of the Heart.

This is a secondary ailment, usually resulting from the effects of parasites in the blood stream.

4. Valvular Diseases.

This is co-incident with, and caused by the same pathological conditions as hypertrophy of the heart.

These diseases of the heart in sheep are rarely, if ever, diagnosed during life. The chief object in mentioning them is to enable the practitioner to guard against invasions of similar nature in apparently healthy members of the flock. "Brisket-disease," somewhat common in cattle at high altitudes, has not been reported in sheep.

CHAPTER XI.

DISEASES OF THE RESPIRATORY ORGANS.

1. Epistaxis.

Hemorrhage from the nose; nasal hemorrhage; bleeding from the nose.

This is merely a secondary condition, following injuries to the head and nose, parasites, and acute infectious diseases.

Treatment: When the blood shows no sign of coagulation tampons of absorbent cotton, saturated with tincture of iron, tannic acid, alum, turpentine or adrenalin chlorid, charcoal or even earth, may be applied.

This Camp of the A. E. F., "Somewhere in France," in the Pyrenees Mountains, Was One of the Many Where Large Quantities of Warm Woolen Clothing Were Required.

2. Nasal Catarrh.

Snuffles; colds; coryza.

This ailment is one of the most difficult to treat satisfactorily, and, like colds among the human race, seems more or less contagious. For this reason, affected animals should be isolated at the very first symptoms. It ordinarily results from exposure to cold or rain; dipping or shearing too early; dusty corrals or musty hay; weed pollen, or parasitic invasion.

The predisposition to "snuffles" seems to be hereditary, and long-wool breeds suffer the most. It is very prevalent in small farm flocks, kept in circumscribed pastures, while range sheep are almost free from the trouble, except when it assumes the form of a mild epizootic.

Symptoms: These are self-evident from the discharges from the nostrils and eyes. Sometimes the animal has difficulty in breathing, and, during hot weather, when afflicted by flies, suffers greatly. Cases have been known in which suffocation and death have occurred, and in all cases, the loss of weight and wool is very great unless relief is given. It is a mistaken idea for owners of stock to view this as a minor trifle, for we all know how miserable the poor animals must feel.

Differential diagnosis: Great care must be taken to differentiate the simple forms of "snuffles," or coryza, from the contagious forms of hemorrhagic septicemia, grub in the head, foreign bodies in the nostrils, and invasion of gnats.

As the common causes are cold, dampness, dust and pollen, the exciting factors in the trouble must be removed before any line of treatment is attempted.

Treatment: To achieve any successful results, the owner should be advised as to the difficulties, and his cooperation, in the way of hygienic care, good nursing and persistent medication, should be insisted upon.

First of all, a complete change in quarters is advisable. Clean, bright forage and pure water should be furnished, and the ones most affected can be isolated.

The nostrils should be cleansed with a cotton swab, after allowing an ounce or so of a saturated solution of boric acid to run up the nasal passages. For this purpose, the animal should be held on its back, and the medicine heated to blood temperature.

Such agents, as camenthol, mentholatum, or any combination of camphor, menthol, eucalyptus or compound tincture of benzoin may then be given as a nasal injection. However, these should be well diluted, as the tissues of a sheep are very delicate.

Hypodermic injections of creosoted ethereal camphorated oil (five mils containing from 10 to 15 grains of camphor) can be given daily. Or the following may be given per orem and abort an attack of pneumonia or bronchitis:

℞

Creosoti, beech........................ʒii
Spirits camphorae........................℥iv
Ol. lini q. s. ad........................℥xxxii
M. Sig. Give one tablespoonful three times daily.

For a good systemic tonic, one may give:

℞

Potass. bichrom........................ʒi
Tr. Fer. chlorid........................ʒii
Aquae q. s. ad........................℥viii
M. Sig. One teaspoonful on tongue three times daily.

Complete disinfection of feet, face and head parts should be given, and all discharges from the eye removed. In valuable animals polyvalent or autogenous bacterins may be tried.

Nasal inhalations of eucalyptus, menthol, turpentine, camphor or the like do not seem very beneficial.

3. Non-Parasitic Bronchitis.

Frequently a sequela of nasal catarrh.

Cause, symptoms and treatment practically the same as for nasal catarrh.

Verminous bronchitis, caused by lung worms, is considered in the section on parasites.

4. Japp Disease.

This is a disease not found in this country, but common in parts of Germany. It is characterized by an intense bronchitis. No cause nor cure has yet been discovered.

5. Bronchial Croup.

Cases are on record of lambs having succumbed to a croupous inflammation of the bronchii.

The course is rapid and fatal, death occurring from suffocation. The cause is not known, and this is merely mentioned for reference.

Treatment has not proved satisfactory.

6. Croup.

Sometimes seen in lambs, assuming the character of a fatal membranous croup.

The symptoms are choking, coughing paroxysms, quickly terminating in suffocation, bloat and death. Sometimes the tympanites is absent.

Treatment: In all cases of this kind, croup should be treated as a contagious disease, and immediate isolation and disinfection advised.

Dilute tincture ferric chlorid may be given, or potassium chlorate solutions. Common vaselin may be used to assist in cutting away this membranous phlegm.

Calcidin dissolved in warm water may be given in thirty-minute intervals in ten-grain doses, while camphorated oil may be administered as a heart stimulant. Inhalations of menthol, oil of eucalyptus or turpentine may help to alleviate the choking.

7. Pneumonia.

Inflammation of the lungs; lung fever; pneumonitis; and congestion of the lungs.

Three types are recognized in sheep:

a. Parasitic—due to lung worms.

b. Traumatic—caused by drenching.

c. Common congestion of the lungs, caused by exposure; chills; wet weather, and as a sequela of nasal catarrh or bronchitis.

Symptoms: These are characteristic, but very difficult to differentiate from acute poisoning, at the onset. Cough; labored respiration; loss of appetite; congestion of the visible mucous membranes, followed by weakness, are present, and often followed by death. In large bands, as many as fifteen hundred sheep have succumbed within a few days, during a season of wet or cold weather.

Differential diagnosis: The sporadic type should be rather easily differentiated from parasitic infestation, such as maggots, lung worms or estrus ovis.

When large numbers succumb in a short time, it must be differentiated from plant or forage poisoning, which is accompanied by convulsions and is of short duration.

Blackleg and hemorrhagic septicemia are accompanied by the characteristic lesions.

Rabies by the resultant paralysis, and absence of anatomical changes in the thoracic viscera.

If large numbers are dying evidently from simple pneumonia brought on by starvation and exposure, a bacteriological examination should always be made.

Treatment: In no disease are hygienic measures more important, and when these cannot be given, attempts at medical treatment are useless. Camphor and creosote, such as has been suggested for nasal catarrh, or spartein sulphate, given in five-grain doses, hypodermatically, may be given.

Five mil. camphorated oil (ethereal) may be given hypodermically as required. This is an excellent heart stimulant, without any toxic effects.

Mixed bacterins can also be administered.

Giving medicines by the mouth will not be found very useful for the patient, but may serve to keep the owner busy.

8. Dyspnea.

Shortness of breath.

Seen in various diseases, obesity, inhalation of smoke, and after excitement.

Treatment is symptomatic, but as a general stimulant, hypodermic injections of sterile ethereal camphorated oil or one-twentieth grain of atropin may be given. Glonoin may be used in complete collapse, but when this occurs in a sheep, very little treatment of any kind will prove successful.

9. Cough.

Cough is a visible symptom of some irritation of the respiratory system. It may be of a non-contagious character, such as produced by dust, weed pollen, musty hay, or simple coryza from dampness and cold, or of a contagious nature, as in hemorrhagic septicemia or parasitic invasion (called "hoose").

Treatment is merely symptomatic.

10. Pleurisy.

Inflammation of the pleura; pleuritis.

This affection is a common sequela of pneumonia.

Symptoms: The manifestations are quite characteristic. The animal grunts as it breathes, and the flanks are more used than the chest. There is a loss of appetite and suspension of rumination. On percussion, dull sounds are heard on the lower edge of the chest.

Treatment: When this disease has become established, therapeutic measures are more or less useless. In valuable animals, fifteen-grain doses of potassium iodid may be given three times a day. The prognosis is grave.

CHAPTER XII.

DISEASES OF THE DIGESTIVE SYSTEM.

Disorders of the digestive system probably cause more losses than from all other sources combined. Errors in feeding, parasites, poisons, and predatory animals all take their toll of life in large numbers, but all fall far behind those ailments originating in the alimentation in the extent of loss occasioned the sheep industry.

1. Stomatitis.

See Section on Diseases of the Lamb (page 173); also Foot Rot (page 117), and Foot-and-Mouth Disease (page 112).

2. Choke.

Obstruction of the esophagus.

This is a rare condition found in sheep, but when it does occasionally occur from the lodgment of a sharp-pointed piece of root in the esophagus, great excitement reigns among the sheep herders. They seem to think an animal breathes through its gullet, and a few moments' delay will cause suffocation, and death.

Symptoms: The manifestations of this ailment are very pronounced. Labored breathing; sudden loss of appetite and rumination; bloating; normal temperature, and attempts to swallow, all differentiate the clinical picture from acute poisoning for which it may be mistaken at the onset.

Treatment: If the obstruction can be felt in the neck, massage may be tried. An equine catheter may be used as a probang, and the obstruction dislodged by its steady pressure. A quarter grain pilocarpin administered hypodermically often gives relief within an hour or so.

If the obstruction seems pocketed, and the pilocarpin proves unavailing, one may give one-tenth of a grain apomorphin. In about fifteen minutes, attempts should be made with a small rubber hose or probang to push the object down into the rumen. In all cases, the veterinarian should render a more or less doubtful prognosis, for usually the animal has been tampered with, sometimes with fatal results. Due to ignorance and great excitement, the trachea is often invaded by small broom handles used to "push down" the obstruction, resulting in the development of traumatic pneumonia.

A few hours after the choke is relieved, a raw egg, beaten up in a little warm water, may be given to soothe the irritated membranes.

The great danger is from bloating. The use of the trocar should not be neglected if at all indicated, for collapse in sheep occurs when least expected. Due to the heaviness of the fleece intense tympany in sheep is often not detected until too late to save the animal.

In case the obstruction proves stubborn and "watchful waiting" avails nothing, immediate slaughter may be advised.

3. Indigestion.

This is a collective term, embracing many digestive disorders, such as colic, impaction, mild tympanites, or any other condition in which the normal functions of the stomach and bowels cease for the time being.

This may be acute or chronic, and, depending on the course, may be mild, severe or fatal.

It is particularly dangerous to pregnant ewes; common sequelae being abortion, gastro-enteritis, stercoremia, and septicemia. In dealing with "indigestion" in this class of sheep, a doubtful prognosis should always be made, even in apparently mild cases.

4. Loss of Cud.

This is merely a symptom of some abnormal condition, ranging from excitement to a contagious disease. Usually, however, it is due to some digestive disorder.

The treatment is symptomatic; the withholding of food, abundant water and salt, and sufficient exercise, being indicated in all cases.

The empiric treatment of giving a rind of salt pork or a fragment of a well-used dishrag may induce increased salivation and hasten a resumption of normal digestion; it is this action that has given such popularity to these "remedies."

5. Gastro-Intestinal Catarrh.

This condition is the result of ingestion of indigestible food or the sequela of some acute digestive disorder, such as impaction, mild cases of enteritis or forage poisoning.

Symptoms: Lack of appetite and thrift; wool becomes harsh and skin rough; feces may be covered with more or less mucus, and, after a chronic course of several weeks to a month, the animal may die.

Treatment: Nourishing food, with the daily addition to the ration of whole flaxseed, in teaspoonful doses. Abundant water, and not too much salt at a time. Bran and whole oats, equal parts, make an excellent grain ration. As a general tonic, the following will be found very good:

Flext. nuces vom.
Flext. cascara sag.
Liq. Potass. arsenitis q. s. ad.
M. f. sol.
Sig. Shake well and give teaspoonful several times daily.

6. Stercoremia.

Toxins absorbed from retained feces.

This is a condition which Bruce of Canada states is often confused with eclampsia and paralysis. It might be termed the correct cause of non-contagious "blind staggers."

Symptoms: Inappetence, dullness, constipation, with resultant straining; later, frothing at the mouth, apparent blindness and "staggers". The animal becomes paralyzed, and may lie on the side apparently in a moribund state for several days.

The mortality is very high among pregnant ewes; other sheep usually recover if prompt treatment is instituted.

The postmortem lesions, as found by Bruce, consisted of a very light-colored liver; great constipation, and more or less inflammation of the intestinal mucosae.

Treatment: Withdrawal of food, abundant water, and exercise. Animals able to move, should be compelled to walk or run several miles daily. A pint of mineral oil may be given to soften the intestinal contents, followed in several hours by the *barii chloridum* and *antimonii et potassii tartras* treatment.

This disease commonly occurs in the winter or early spring.

7. Bloat.

Hoven; blasting; meteorism.

This condition is a common one in the West; large numbers of sheep are lost annually from acute bloat. Any kind of forage may cause the trouble, especially after a rain. Wet alfalfa is particularly deadly.

In the fall, after having been on the summer range, the sheep are trailed leisurely back over the rich farming sections to the "home ranch." Wheat or oats stubble is rented by the sheep man and the animals turned in. Hungry for grain, it is remarkable how much the animals can pick up in a few hours. If there is any alfalfa near and available, trouble may ensue, not only from bloat, but from founder. Quick action is required by the attending veterinarian, and the treatment heroic. The small-dose teaching of textbooks must be cast to the winds, and the medicines given in quantities that would cause an inexperienced veterinarian to shudder.

Symptoms: One or more animals stand with a look of helpless pain; respirations are labored, and the abdomen distended in an "apple-shape." Soon the animal staggers, tries to stand up, but drops to the ground and succumbs in a convulsion, the immediate cause of death being suffocation.

Treatment: Thousands of "sure cures" for bloat have been recommended. If they are available, it is suggested that turpentine, oil of eucalyptus, aromatic spirits of ammonia, formalin, fresh milk and coal oil be used. As this is a "first-aid emergency," one must think and act quickly, and be able to use what therapeutic agents are at hand.

We will suppose a hundred head of sheep have had access to a "big feed," and the animals are not only bloated but foundered. Here we have a complicated condition—a double calamity—and our measures must be directed, first, to lessening the formation of gas, and next, to alleviating the intense congestion of blood in various parts.

Two buckets of medicine are hastily mixed up, each containing two gallons or two hundred and fifty-six ounces, which will treat one hundred and twenty-eight head, giving each animal a two-ounce dose syringe full.

In prescription "A" we figure on giving one dram each of turpentine, oil of eucalyptus, aromatic spirits of ammonia in enough raw linseed oil to make two ounces. Consequently our prescription would read:

℞
Spt. Ammon. Arom.
Ol. eucalypti.
Ol. Terebinth. aa..............................ʒxvi
Ol. lini q. s. ad..............................Cong. ii
M. f. sol.
Sig. One two-ounce syringe full at once. Repeat in fifteen minutes in subacute cases.

For the laminitis, the following can be given as soon as the bloat has subsided to such an extent that the animal seems to be somewhat improved:

℞
Kali permangan.
Alumen sulph. aa..............................ʒviii
Aquae q. s. ad..............................Cong. ii
M. f. sol.
Sig. One two-ounce dose syringe full an hour after first medicine has been given.

By the use of three or four syringes and grouping the help in pairs—one to hold the animal, and the other to administer the medicine, a hundred head can be gone over in a few minutes. The main thing to impress on those who administer the medicine is to give the half-suffocated animal plenty of time to swallow the drench.

In case the before mentioned drugs are not available, with less success one may resort to ground ginger, milk, black pepper, or even whiskey.

8. Impaction of the Rumen.

This is a chronic bloat or a distention of the rumen caused by fermenting food of a solid nature.

Symptoms: Dullness; loss of appetite and rumination; doughy feeling in the flank, the rumen seeming to be of the consistency of a mass of dough.

Treatment: The following prescription will be found excellent:

℞
Barii chloridum.
Ant. et Pot. tartras aa..............................ʒss
M. f. pulvus No. VI.
Sig. Dissolve one powder in several ounces warm water and give every two hours. About 3 doses are enough.

After using these powders alone, dram doses of aromatic spirits ammonia well diluted or ten drops fluid extract nux vomica in water may be given three times daily.

When there is much gas, the trocar should be used, and the triple sulpho-carbolates can be given in ten-grain dosage.

9. Grass Staggers.

Fardel bound; drying up; staggers.

Impaction of the third stomach (the omasum or manyplies) is a very fatal condition and treatment has proved to be of little value. Upon autopsy, the spaces between the leaves of this stomach will be found packed full of dried material, and the mucous membranes nearly black.

Treatment: Practically as for impaction of the rumen, except that a diffusible stimulant can be given at once.

10. Constipation.

Impaction; clog; twist, wool balls.

In adult sheep this often occurs from dry pasture and insufficiency of succulent food and water. Timothy hay will also cause this condition, even with plenty of salt and water. In lambs, wool balls is a frequent cause.

Symptoms: Loss of appetite; "humped up" appearance; attempts to defecate; colicky pains; and hard masses of feces in the rectum.

Treatment: As indicated in impaction of the rumen. This will give better satisfaction than large doses of salts. In cases of chronic constipation, four-ounce doses of mineral oil twice daily will be found very beneficial. However, laxative feeds, such as alfalfa, bran, whole oats, flaxseed or molasses will be found better than medicines.

An enema, containing half an ounce of glycerin, is always useful. Laxative food, such as whole oats and bran, equal parts, should be given when the animal regains its appetite. Do not give too much treatment, or the animal may "die getting well."

In suckling lambs, give the ewe a tablespoonful of sodium hyposulphite per day. The lamb may be given one or two ounces of castor oil, together with an enema.

11. Colic.

Stretches; belly-ache.

In sheep this condition usually arises from eating spoiled forage, frozen roots or mild poisons.

Symptoms: The animal stretches out so far that it appears "sway-backed," hence the term, "stretches." It lies down and then gets up again, and appears to be in great pain.

Treatment: In sheep, one-half ounce each of fluid extract dioscorea and sweet spirit of nitre given in a little water has been found useful. In cases of much fermentation, thirty grains of the sulphocarbolates, with a dram of fluid extract ginger, may be given. Turpentine, oil of peppermint, or any of the carminatives or stomachics may be given.

Lambs may be given one-half the above dosage. The ewe if suckling her young may be fed laxative food, and a tablespoonful of sodium hyposulphite per day.

12. Diarrhea.

The Skit or The Skite.

In sheep three forms may be recognized:

Sporadic or non-infectious diarrhea of the newborn lamb.

Infectious diarrhea. Considered in the section in diseases of the lamb.

Common dysentery of sheep. This is caused by spoiled food; exposure; lack of exercise, or it may be the symptom of some acute poisoning or infectious disease.

Treatment: Successful treatment is largely symptomatic. Immediate removal of the exciting cause is necessary. Twenty grains of subnitrate of bismuth given in a little condensed milk is good. Triple sulphocarbolates, salicylic acid, salol, castor oil, linseed oil, milk of bismuth, all have their place, and many other drugs have been usefully employed in this disorder. Hygienic care will do much to alleviate the trouble.

The following prescription is very efficacious:

℞

Fldext. catechu	ʒi.
Creosoti Beech	gtt. x
Spts. camphorae	ʒii
Ol. ricini q. s. ad	℥iv

M. f. sol.

Sig. Give one ounce several times daily.

13. Enteritis.

Inflammation of the bowels.

Four types of enteritis in sheep are recognized:

Simple, or non-toxic enteritis. This type is caused by chills; eating irritating food; foreign bodies or parasites in the intestinal tract. It is also a sequela of constipation or diarrhea.

Croupous enteritis. This occurs from feeding too much chaffy food, such as "straw-stack and scenery" in the spring, following a hard winter. Dram doses of sodium bicarbonate several times daily, with nourishing foods, seem to be as beneficial as anything yet tried.

Mycotic enteritis. This is the most common type among sheep. It is due to the ingestion of moldy or fermenting foods. Thousands of sheep are lost yearly from this disease alone. The trouble is especially fatal among pregnant ewes, causing abortion, and later, death from metritis. Often the most painstaking and careful examination is necessary to arrive at a correct diagnosis.

The symptoms are sudden and severe. There is complete loss of appetite; dullness; colicky pains; constipation, followed by a copious diarrhea, in which are long strings of slimy mucus. Paralysis completes the clinical picture, and death occurs in a comatose condition. The exact kind of poison or toxic ingredient in the food largely controls the symptoms, and sometimes they are very violent in character. The history of the case and an autopsy on animals already dead, help one to arrive at a conclusive diagnosis.

The treatment in the main is unsatisfactory, for the ailment has usually progressed too far for medicinal aid to accomplish much. Stimulants, antiferments, and intestinal antiseptics, together with rectal injections, complete the treatment. Only in case of large losses or fear of some contagious disease is expert assistance ever called.

Toxic enteritis. See section on Poisons.

14. Piles.

This condition is very rare in sheep. Complete withdrawal of food for several days, with applications of belladonna ointment to the affected parts, is all that is required.

In bad cases the extruded part can be ligated with catgut, or silk, and excised.

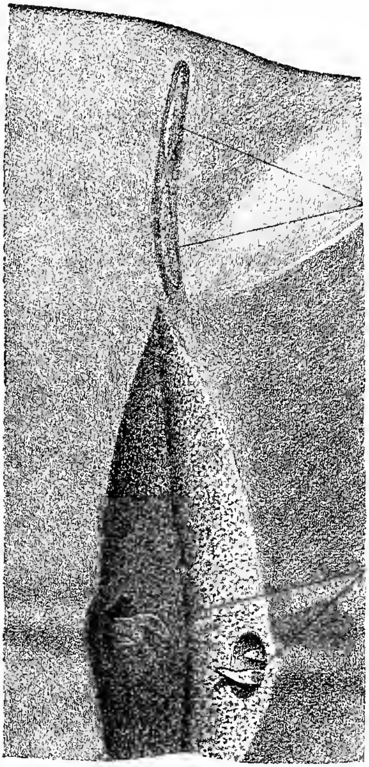
CHAPTER XIII.

DISEASES OF THE LIVER.

1. Icterus.

Jaundice; yellows.

This disease is frequently seen in packing houses. It is very rarely noticed until after slaughter, except in advanced cases. It is commonly caused by the liver-fluke; for a complete consideration of this subject see the section on Parasitic Diseases of


Small flukes showing through enlarged bile ducts.
Section of a large bile duct showing flukes.

Enlarged Section of Bile Duct of Left Lobe of Sheep Liver.

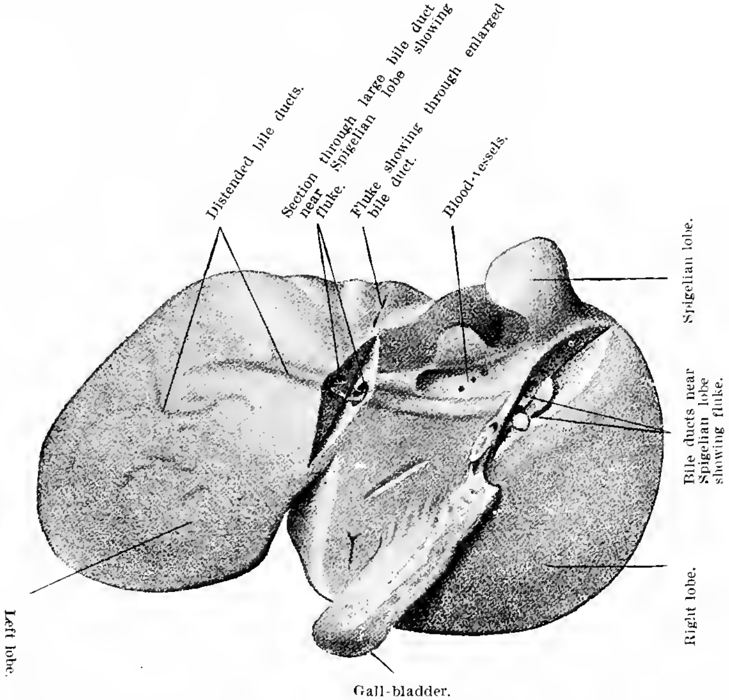
Sheep. Lead poisoning has also been known to cause this disorder.

Treatment: If of parasitic origin, treatment is, of course, out of the question. Laxative food, combined with two-ounce doses sodium phosphate, may relieve simple cases.

2. Hepatitis.

Inflammation of the liver.

When seen, it is usually the result of feeding on marshy land when the forage is too rich in proteid content.


Distended bile ducts.
Section through large bile duct near Spigelian lobe showing fluke.
Fluke showing through enlarged bile duct.
Blood-vessels.
Spigelian lobe.
Bile ducts near Spigelian lobe showing fluke.
Right lobe.
Left lobe.
Gall-bladder.

Gastric Surface of Sheep Liver, with Enlarged Bile Ducts Following Infestation with Liver Flukes.

The only practical treatment consists in change of feed and plenty of exercise.

3. Lupinosis.

See Section on Poisons.

CHAPTER XIV.

DISEASES OF THE PERITONEUM.

1. Ascites.

Dropsy; abdominal dropsy; hydrops ascites.

This is a comparatively common ailment among sheep on the western range, and is not a disease in itself, but the visible symptom of some chronic affection of a vital organ of the body, such as the heart, the kidneys, the lungs, the mesenteric glands or the portal vein.

It is the term applied to the collection of serous fluid found in the peritoneum not due to inflammation.

Under the general head of ascites may be mentioned hydremia, which is an increase of the fluid parts of the blood with a corresponding lessening of the solid constituents. This is frequently seen in parasitic invasions, or in chronic lead or zinc poisoning, and is known among sheepmen of certain localities as "dry-rot."

Symptoms: These are self-evident, but the following facts should be kept in mind:

a. Gradual enlargement, especially a bulging out posterior to the last pair of ribs. In shorn sheep this is very noticeable.

b. Palpation of the lower part of the abdomen produces the typical dull sounds, indicating the presence of fluid, while the upper part is tense, light and gives a drum-like sound.

c. Raising and lowering the animal gives forth a "swishing" sound, as the fluids roll back and forward.

d. Holding the animal up by the hind legs accelerates breathing as the fluids roll forward and press on the diaphragm. Also, tipping the sheep to one side causes a distention on that side.

e. Normal temperature.

f. Rumination becomes lessened; the appetite is greatly diminished, and later, the animal becomes dull and mopes around. The visible mucous membranes become pale; the body emaciated, and the general verdict around the sheep camp is that the animal has the "rot."

The important thing to remember is to differentiate this practically incurable, non-contagious disease from:

a. Pregnancy. No disturbance of the health.

b. Peritonitis. In this condition there is pain, fever, with all its attendant disturbances of the general health.

c. Obesity. This occurs usually in old, closely confined animals. Range sheep are seldom troubled with this malady.

d. Paralysis of the bladder, or even rupture of that organ, due to uerthral calculi of bucks and wethers. In this trouble there are found colicky pains, high temperature, odor of urine on the breath, followed by collapse and death. In this condition, at the first symptoms, great care must be taken to differentiate the troubles.

e. Other rare but possible ailments, such as pyometra, abdominal cysts, hydrometra, abnormally large tumors, cystic kidneys, degenerated kidneys, or mummified fetuses in ewes. In some cases large quantities of impacted feces have been known to cause the distention of the whole abdomen.

These have been gone into in detail to prevent the embarrassment consequent upon a superficial examination and a too hasty diagnosis.

Treatment: In cases of long standing, slaughter is advised. Should some pure-bred animal of high value contract this disease during the show circuit, one may alleviate the trouble by giving daily twenty drops fluid extract pilocarpin, or one-half dram each of resublimed iodin and potassium iodid dissolved in a couple ounces of water.

2. Peritonitis.

Only seen as a secondary condition following bruises, wound infections, enteritis or puerperal infection. The treatment should be symptomatic; the results are usually very unsatisfactory.

CHAPTER XV.

DISEASES OF THE BRAIN AND CORD.

Sheep are subject to many disorders of the brain and cord, but most of them are of parasitic or toxic origin, and very little can be done to alleviate the actual condition. We can, however, by careful autopsies, find the existing cause, and take preventive measures to preclude further extension of the trouble.

1. Encephalitis.

Inflammation of the brain.

This is caused by the invasion of the "gid" parasites; fractures of the skull; exposure, and poisons.

There is no known treatment that is satisfactory.

2. Apoplexy.

Under this heading may be grouped sun stroke, heat stroke, epilepsy, fits and convulsions.

It is usually of parasitic origin, except in very warm weather and in animals that are abnormally fat.

Except for the removal of the exciting causes, no treatment is practical.

Hypodermic injections of 5 mil, ethereal camphorated oil, or bleeding from the facial veins or ears may be of some benefit. Remember, in these cases something must be done, the least harmful the better. Spontaneous recovery often takes place, and one should not be too hasty in a prognosis or diagnosis.

3. Paralysis.

Frequently a sequela of acute infectious diseases, poisons, intestinal parasites, or cysts in the brain. In lambs it is associated with eclampsia of the ewe, both being caused by poor food, exposure or the infection that causes abortion.

When of non-parasitic origin, twenty-grain doses of potassium iodid given in an ounce of water several times daily will do as much good as anything.

4. Coma.

Sometimes seen in animals struck on the head by rocks rolling down a steep incline in the mountains. Also found in the last stages of plant poisoning, acute infectious diseases and intense parasitic invasion. In ewes it is found in shock (which see on page 164).

Treatment: Is largely symptomatic, but cold applications to the head; bleeding by cutting the ears, and camphorated oil or atropin hypodermically is about all that can be done.

5. Vertigo.

Blind staggers; megrims.

In sheep usually caused by parasitic infestation, as gid or grub. However, it may be due to acute infectious disease, such as hemorrhagic septicemia, or rabies; to plant poisoning; lack of exercise and over-feeding, causing a cerebral congestion.

A WESTERN SHEARING CAMP.

About 1,200 are sheared in a day in this small camp.

6. Epizootic Cerebro-Spinal Meningitis.

Being a symptom only, the cause should be ascertained, if at all possible. It is a good plan to isolate the animal at once. Atropin, camphorated oil and cold applications may be given.

Cases have been recorded in England where sheep were affected with a curious malady, accompanied by grinding of the teeth, muscular tremors, convulsions, and death. Nothing is known of its character.

It is mentioned because of its resemblance to rabies.

7. Shock.

This unfortunate sequela frequently follows parturition, eversion of the vagina, uterus or rectum, eclampsia, or injuries.

Due to the lack of resistance on the part of the sheep to resist shock, one should always give a guarded diagnosis, for many animals "die getting well", and no reasonable explanation can be given or found for the sudden fatal termination.

Camphorated oil, atropin or glonoin can be given when first seen.

8. Heat Stroke.

Over-heating; sunstroke.

This is sometimes caused by excessive humidity, intense sunshine with no protection, or may be predisposed by fright, extreme exertion, or excess fat.

Symptoms: The animal becomes stiff, has muscular tremors, great weakness, and often has a glassy stare.

Treatment: Quietly remove the animal to a shady place, as cool as possible. Inject hypodermically 5 mil. camphorated oil. Apply cold water to the head, and keep the animal free from noise or excitement. In cases of collapse, one-fortieth grain strychnin or small doses glonoin can be used.

When the animal is able to swallow it may be given four ounces Epsom salts dissolved in eight ounces warm water, and if there is a hard, wiry pulse, five drops fluid extract aconite or veratrum viride may be added.

9. Gid.

See section on Parasites.

CHAPTER XVI.

DISEASES OF THE ORGANS OF LOCOMOTION.

1. Rheumatism.

Cause: Usually damp quarters; exposure; chills, or watery food.

This is a very rare trouble in sheep but sometimes appears as an enzootic due to the causes enumerated above.

Symptoms: Sometimes in the first stage, a very high temperature is recorded, with labored respiration and stiffness of the gait. This makes it very difficult to correctly diagnose the trouble on account of the similarity of symptoms found in pneumonia, poisons, and acute infectious diseases.

Treatment: Removal of the exciting causes, together with hygienic care. Twenty-grain doses of potassium iodid or ten-grain doses sodium salicylate several times daily may prove beneficial.

In certain localities a deficiency of mineral salts has been found to cause so-called "rheumatism." The bones are soft, and the least effort at locomotion is extremely painful. For this, of course, the proper line of treatment is available mineral elements, and one of the several "licks" (page 86) may be resorted to. One or two cases in a band may be merely the signal of a lack of minerals, and a small amount to all will be beneficial. Tincture of iodin in ten-drop dosage or potassium iodid, one grain, several times daily should also be given in case thyroid disorders are present.

CHAPTER XVII.

NON-PARASITIC DISEASES OF THE SKIN.

Only after the most careful examination should a diagnosis of non-parasitic disease of the skin be made, and then it is the best policy to keep a close watch on the affected animals and to isolate them from the apparently healthy ones.

1. Non-Parasitic Itch.

This condition is so rare in sheep as to merely merit the mention that it may and does occur, the exciting causes being rich food, lack of exercise or crowding.

Treatment: Removal of the predisposing causes, with teaspoonful doses liquor potassi parsenitis several times daily for a few days.

Locally, any bland ointment, such as lanolin and glycerin, equal parts; carbolated vaselin or zinc oxide ointment may be applied night and morning. Obstinate cases sometimes heal if swabbed with the following several times daily:

℞

Sod. Hyposulphit	ʒii
Glycerini	℥i
Aquae Dest. q. s. ad	℥iv

M. Sig. Apply as directed.

2. Alopecia.

Falling out of the wool; baldness.

This is frequently seen on the range, and to the inexperienced, looks like scab. Ewes that have lost their lambs and have had severe attacks of mammitis or "blue bag" are common victims. Sometimes lack of food and exposure are contributing factors.

No treatment has been found successful, except to let it alone, and in case of old ewes, prepare them for market.

3. Eczema.

This condition may arise from insect stings, cockle-burrs, rain storms followed by rain-rot, or too strong dips.

Five classes of eczema are recognized, although in practical work everything not scab is commonly called eczema.

Chronic squamous eczema is a disease of parasitic origin usually, such as liver fluke or lung worms. It may also be due to lack of proper care.

Greasy heels, resulting from muddy or damp ranges or pens.

Fat scab, due to dampness, often called "rain-rot."

Solar eczema, due to irritation from the rays of the sun immediately after shearing.

Intertrigo or erythema of the claws and interdigital space due to friction by sand or the like getting into the parts.

Treatment: Removal of the exciting causes, and feeding of light, nourishing foods.

4. Echthyma.

A form of eczema, very difficult to diagnose from variola and sarcoptic mange. Ammoniated mercury ointment may be used.

5. Decubitis.

Bed sores.

These are rarely seen in sheep,due to heavy wool protection. When occurring on exposed parts of the body, the common white lotion is soothing and astringent.

6. Acne.

Known as "summer scab." Closely associated with eczema.

7. Buckwheat Rash.

Fagopyrismus.

An exanthema of the skin seen in buckwheat-raising sections. Sunlight plays an important part, and the disease is very sporadic, occurring only in certain seasons.

Cause: Buckwheat and sunlight. Just how these exert their influence is not known.

Symptoms: Mild cases exhibit a reddening of the skin.

Severe types resemble erysipelas. Nervous disturbances, such as great excitement, convulsions, followed by death have been reported.

Differential Diagnosis: Any affection of the skin in sheep should be looked on with suspicion. Previous history; the presence of sunlight; feeding on buckwheat, and a simple erythema will lead one to differentiate it from variola, eczema, scabies or ringworm.

Treatment: An immediate change of food; a shady shelter and laxatives are indicated. Should the severe type be present, application of carron oil (equal parts lime water and raw linseed oil) or the following may prove helpful:

℞
Flext. stramonii .... ℥ss
Plumb. acetatis aa .... ʒii
Aquae q. s. ad .... ℥viii
M. f. sol.
Sig. Apply to parts several times daily.

8. Burns.

In the West, great forest fires frequently sweep over a forest range where sheep are herded, traveling with such rapidity that whole bands of animals may be destroyed, or many burned slightly. With prompt aid, many of these may recover, although due to the inhalation of smoke, a guarded diagnosis should be made. Again, the veterinarian may be called to a small farm flock affected from a fire on the premises.

Treatment: First aid should comprise applications of a saturated solution of picric acid over the burned parts. This solution can be made up quickly by dissolving three drams picric acid in a quart of boiling water. It may be swabbed on with cotton.

Carron oil, made by mixing equal parts lime water and raw linseed oil, is also very good.

Unguentum is excellent and easily applied.

Should only "camp remedies" be at hand, soda, starch, flour, castor oil, turpentine, boric acid, talcum powder, or any unsalted grease may be applied.

If at all possible, administer hypodermically 5 mil. sterile camphorated oil as a heart stimulant.

9. Cold Exposure.

Chill; freezing; frost-bite; numbness.

If a lamb becomes numb from exposure to the cold, it may be dipped in warm water (about blood temperature) and more hot water added, until it begins to show signs of life. Then it should be dried, wrapped up in a warm blanket, and as soon as it can swallow, given a little warm milk, to which a few drops of aromatic spirits of ammonia may be added.

Due to the protective covering of wool, sheep seldom succumb to cold weather, but may get chilled after shearing, during a cold rain, snow, hail or blizzard, which sometimes occur in the late spring with disastrous results. The victim should be taken into a warm place, and the limbs worked energetically. Camphorated oil should be injected hypodermically, and as soon as the animal can swallow, teaspoonful doses aromatic spirits ammonia, sweet spirits nitre, spirits camphor or any other stimulant at hand may be given carefully. A small pinch of powdered ginger mixed in a little molasses or syrup smeared on the back teeth or tongue will "warm up" the animal.

10. Ringworm.

Herpes. Tricophytosis.

This is a rather rare disease among sheep, being found chiefly among yearlings or lambs, and occurring in winter, as a rule.

Cause: The *Trichophyton tonsurans*, a vegetable fungus.

Symptoms: Thick, dry crusts are formed around the eyes, nose or neck, rarely upon the body. In the latter case, the wool becomes very tangled and dead looking. At the beginning of the disease there is intense irritation, and parasitic infestation may be suspected.

Differential Diagnosis: A careful and guarded examination is required to diagnose ringworm from other cutaneous ailments at the start. After the crusts have formed, of course, the diagnosis is comparatively simple.

Treatment: Isolation of those affected, and painting the areas with tincture of iodin, grease, "fryings," mercurial ointment, salicylic ointment, Balsam Peru or creolin may be tried. The malady usually disappears spontaneously with the advent of warm weather.

CHAPTER XVIII

DISEASES OF OBSCURE ORIGIN.

1. "Nibbling" Disease.

This disease, also known as "trotting disease," is a very rare affection of sheep in this country, if it occurs here at all, but is common in Germany. The cause has never been fully determined. It was not known in Germany until the fine-wool breeds were introduced into that country. It is most frequent in young rams.

Symptoms: The first noticeable symptom in a ram is excessive timidity; later, they begin to tremble, and have a very staggery gait. In the later stages of the disease the animal nibbles itself on the back and loins, and in several weeks to a month, dies of exhaustion.

Treatment: The most important thing is correct diagnosis. Immediate slaughter is advised, and new blood used in mating. As "gid" produces some similar symptoms, a careful examination must be made to arrive at a correct conclusion.

2. Louping-ill.

Mad-staggers or trembles.

Another obscure disease not found in this country.

Inflammation of the spinal cord from some unknown cause is thought to be the exciting cause. The trembling, twitching, grinding of teeth and general paralysis follow in rapid succession; leading to death.

The treatment is merely preventive, such as removal to other ranges; the introduction of new blood in the form of unrelated sires, and nourishing diet.

Recent investigations indicate that this is an infectious ailment. For a more extended consideration see page 133.

3. Big Head.

A peculiar condition found in parts of the West, especially in the arid desert plains. The cause, cure or prevention is absolutely unknown at the present time.

It occurs in the spring when the sheep are being driven from their winter camps to the forest ranges.

The first symptom is a refusal to eat, and the animal becomes restless as if in great pain. The head begins to swell, and the ears become purplish in color. The clinical picture much resembles purpura hemorrhagica in the horse. Death usually takes place in from several hours to a day or two, although some animals recover.

If the ears be scarified, a serous fluid, of a slightly reddish color, oozes forth; the animal seems to prefer to stand in water.

The rough and ready treatment of the sheep man is to throw the affected animal into a puddle of water or a snow-drift, if the latter is available. A certain number get well, but whether this heroic treatment has anything to do with the recovery is unknown.

There is a form of "big head" found in the Middle West, whose etiology is as obscure as its far western namesake.

The symptoms are loss of appetite, lassitude, temperature around 105° F., the eyes are glued together, and there is a discharge from the nostrils, as well as from the eyes. Later, the tissues of the head and ears begin to swell, much like purpura in the horse. The ears assume a purplish color, and may lop down, being several inches thick. The head may be held up straight, to one side or may droop down to the ground.

Anatomical changes are not pronounced as would be expected from the clinical picture. There is an icteric discoloration of the tissues, and the condition of the victim, whether fat or emaciated, seems to have little bearing on the outcome of the disease.

Treatment consists in an immediate change of pasture, food and water. As has been repeated so many times, this is the first thing to do in any obscure disease.

Medicines should be very carefully administered, and if made into an electuary, will be found less dangerous than drenching. Laxatives, such as four ounces magnesium sulphate twice daily, may be given; other symtomatic treatment may be given, such as local applications of lead and opium solutions, phytolacca, or similar medication, but they seem to give very little relief.

Many theories have been advanced as to the cause of this baffiing ailment, the most plausible being that it is caused by some toxin from the stubble or food.

4. Pustular Eruption of Lambs.

See section on Diseases of the Lamb (page 173).

CHAPTER XIX.

DISEASES OF THE LAMB.

The examination of lambs requires much experience and skill to determine just what the exact cause of the trouble is. The lamb is so delicate and possesses such little resistance to infection, toxemia or injuries that treatment unless promptly instituted, will prove of little avail. However, flockmasters are beginning to realize this, and, while a lamb itself is of little value, its potential possibilities may be great.

When the temperature is very high, bacterial invasion may be suspected. The use of biologics will often work wonders in these cases and convert a doubting sheep-raiser into an enthusiastic client.

The chances of recovery are greatly enhanced if the lamb be normal at birth, even though very weak. If it is not "born right" the case is hopeless from the start. In order, therefore, to get results, one must be able to differentiate these conditions, and advise accordingly before treatment is commenced. A word of explanation before remedial measures are begun are worth more than a page afterwards.

1. Congenital Defects.

Imperforate anus, unless quickly discovered, is incurable. If it be diagnosed early, many cases are amenable to surgery.

Hernia or rupture is rare and difficult to treat. Usually, on the range, the lamb is so stunted that it is knocked in the head.

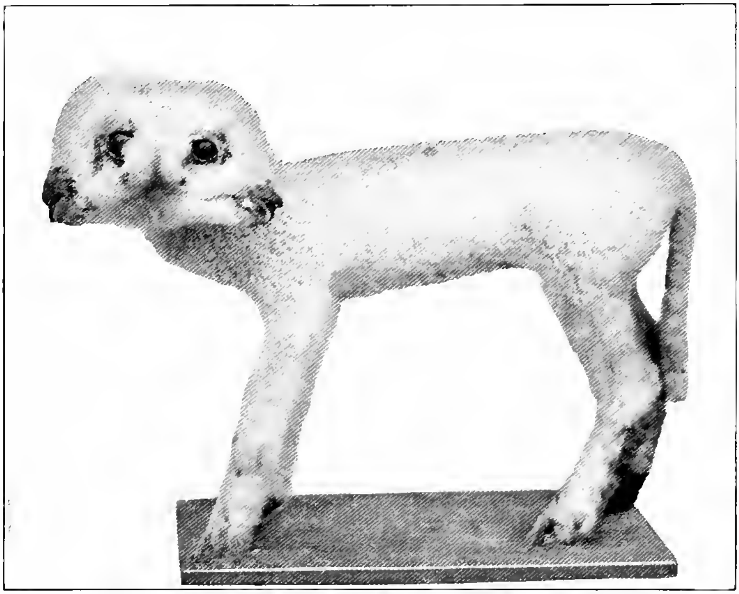
"Skin drying" is caused by the ewe not being able to lick the new-born lamb. Later, its mother will not own it, and, if not attended to promptly, it dies from hunger and cold.

Umbilical hemorrhage or bleeding from the navel sometimes becomes serious. Tincture of iron chlorid applied with a cotton tampon will usually stop the flow of blood. A stimulant should be given, such as a little brandy or aromatic spirits of ammonia.

Suffocation is due to a twist of the umbilical cord during birth, and the lamb is born dead.

2. Reviving "Lifeless" Lambs.

When an apparently lifeless lamb is born, it may be revived in many cases by removing all mucus from the nostrils and mouth; breathing into the nostrils, and working on the chest as in reviving a drowning person. A very successful method, as practised by some breeders, is to immerse the lamb in a bucket of water about blood temperature, pouring in a little hot water to increase the heat. Dry thoroughly, and wrap in a blanket. Later, when it is able to swallow, administer a stimulant.



Double-Headed Lamb from the Yakima Valley, Washington.

3. Pinning.

Retention of the meconium.

This is a term used by sheepmen to describe the hardened mass of meconium or first feces on the anus. This so obstructs the orifice that a fatal auto-intoxication soon takes place unless promptly removed.

Symptoms: The lamb appears listless; refuses to suck, and soon becomes so weak it is unable to stand up. One may first think of navel ill, but an examination of the anus will reveal the cause of the trouble.

Treatment: With lukewarm water and castile soap, soften the mass of fecal matter, and carefully remove with a blunt stick. Then inject a teaspoonful of olive oil into the rectum. The external parts may be anointed with any healing salve, such as vaselin or zinc oxide.

4. Navel-ill.

Joint-ill; blood poisoning; pyo-septicemia of sucklings; omphalophlebitis.

The Bacillus bipolaris septicus, and the Bacillus coli communis, seem responsible for the presence of this disease. They gain entrance to the umbilicus at birth or when the cord is ruptured. In some cases, it is thought the organisms have entered the circulatory system before birth. It is not such a common disease in lambs as in the foal, but outbreaks occur from time to time.

Symptoms: The disease is very easily recognized, for the symptoms are very pronounced and characteristic. The lamb becomes "dumpish" and dull. It has no appetite, and the temperature per rectum will be found to be very high, often 107° F. The stump of the cord assumes a purplish color, and Wharton's jelly becomes tinged with pus. Sometimes, the joints become enlarged. Later, a copious diarrhea sets in, followed by an intense cachexia and death.

Treatment: Where a number of lambs are affected, the logical thing to do, of course, is to remove the whole band to another place, and, if the weather be suitable, to allow the ewes to lamb in the open.

The pus may be squeezed out of the umbilicus of the affected lamb and hydrogen peroxide injected, to be followed by tincture of iodin, turpentine, chinosol, pix-cresol, lysol, or any of the coal tar preparations. Carbolic acid is not as good as other less coagulating antiseptics. Oil of eucalyptus is excellent.

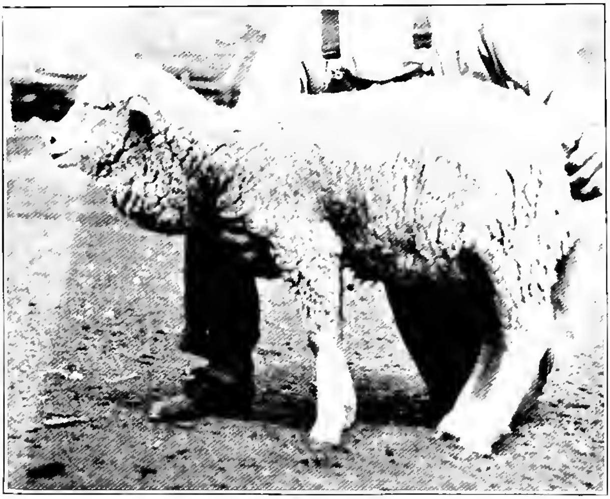
Internally, the lamb may be given twenty grains of the triple sulphocarbolates mixed in a raw egg, three times a day. A tablespoonful of castor oil is also beneficial to correct the weakening diarrhea. Stimulants, antiferments, intestinal antiseptics and tonics, such as echinacea, all have their use.

The chances of successful treatment in lambs that show the typical symptoms are not very good, and a grave prognosis should be given. In the treatment of valuable animals, bacterins may be used.

5. Non-Contagious Diarrhea.

This is usually due to some disturbance of the mother's health, or to the decomposition of food in the stomach of the newborn. Chills, cold, dampness and milk that is too rich are also common predisposing factors. If not checked, it runs a rapid, fatal course, therefore prompt treatment is essential.

Treatment: The exciting cause should be determined, if possible, and removed. Administer to the ewe a tablespoonful sodium hyposulphite twice daily. Milk out the udder thoroughly. Feed her nourishing food, such as bran and oats.



Typical Specimen of Goiter Found in the Western States.

The lamb may be given a tablespoonful of castor oil, to which is added a raw egg and twenty grains of triple sulphocarbolates. Salicylic acid, five grains, in condensed milk, is highly recommended. The following prescriptions have given good results, when preceded by an intestinal antiseptic and castor oil:

℞

Tr. ginger	ʒi
Creosote, beechwood	mv
Dioscorea, Flext	ʒii
Fresh milk	℥iv

M. Sig. Give in two doses, one hour apart.

℞

Tr. euphorbia	ʒii
Creosote	mv
Spts. camphor	ʒii
Elix. lact. pepsin q. s. ad	℥ii

M. Sig. Give in two doses two hours apart.

6. White Scours.

Infectious diarrhea; dysenteria neonatorium.

This disease is caused by the Bacillus coli communis, a small, thick, rod-shaped, motile, non-spore-forming organism, not staining by Gram's method, but with the aqueous anilin dyes. Other germs are thought to cause or assist in the infection.

Symptoms: Newborn lambs, a day or two old, seem to be the usual victims. The lamb becomes dull; loses its appetite, and the feces passed at the first are a bright yellow, later, a foamy, greyish white. The wool is matted, and streaks of mucus are found on it. In a short time, the lamb becomes very weak; the eyes grow glassy, and the victim drops to the floor and dies in a stupor.

The temperature is about normal, and, as death approaches, drops to subnormal.

Treatment: This is not a common disease of the range, but is usually found in low, marshy pastures, or sheds which contain the infection. The logical treatment is to isolate all the apparently healthy lambs, and give the sick ones intestinal antiseptics—a drop of formalin, in a little milk, or sulphocarbolates. The immediate slaughter of those hopelessly affected is advised. Immunization with bacterins may be tried where the stock is valuable. Prevention is the best method to pursue and the most satisfactory to all concerned.

7. Milk Curdling.

Impaction of the fourth stomach.

This is a very fatal disease found in the high altitudes of the West.

Cause: Oversuckling and ingestion of acrid plants, causing a curdling of the milk. It usually occurs when the sheep are being trailed to their summer range, and is perhaps superinduced by the heat, dust, fatigue and haste in suckling. Nibbling at some plants may bring the ailment on, with fatal termination.

Symptoms: The lamb becomes uneasy; respirations labored; eyes of a glassy color, followed by a greatly distended abdomen, stupor and death. Upon performing a postmortem the abomasum will be found full of undigested, curdled milk.

Differential diagnosis: It frequently is confused with plant poisoning, but the age of the lamb, combined with postmortem findings, will soon determine the real cause.

Treatment: When lambs begin to die with "milk curdling," the logical thing, to do, of course, is to rest the band. Then trail to lower altitudes.

Medication has proved well nigh useless, however, tablespoonful doses of milk of magnesia may be tried. In a few minutes, ten drops each of dioscorea and essence of peppermint may be given. Tincture of ginger, aromatic spirits of ammonia or spirits of camphor may be given as a stimulant. In case none of these are at hand, common powdered ginger, with several drops turpentine may be given.

8. Stomatitis.

The sporadic form is known as "sore mouth" among sheepmen. This may be caused by irritation, with secondary infection by any of the pus bacilli.

The contagious form, known as "necrotic stomatitis" is caused by the Bacillus necrophorus.

Either variety may cause loss by becoming so acute as to prevent suckling, with consequent starvation, unless attended to.

Symptoms: These are self-evident. The lips may be covered with reddish-spots, while the mouth may have large patches of sores. There may be intense salivation, and in a short time, great weakness.

Treatment: This condition is so difficult to distinguish from foot-and-mouth disease, that one should take no chances. If the history will justify the supposition that it may be the latter, notify the nearest representative of the Federal Bureau of Animal Industry by wire. This also applies to the necrotic form, as it is very contagious.

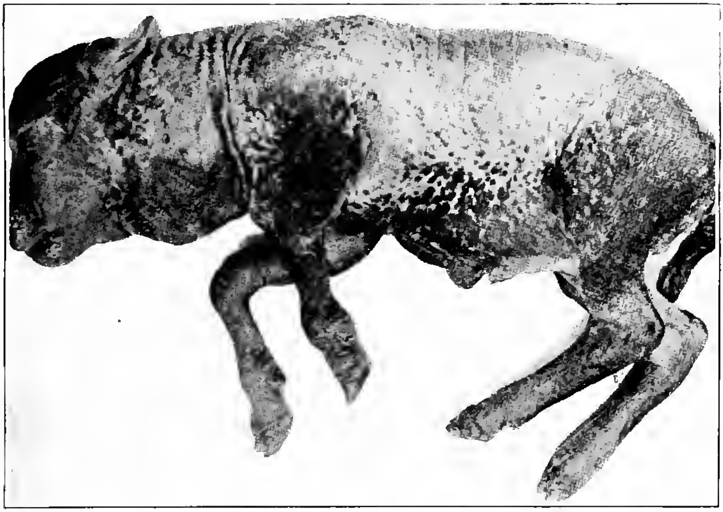
For the simple type, touch lightly with a small piece of copper sulphate twice daily. Tincture of iodin in fifty per cent solution can then be used. In very light forms, or at the beginning, any of the alkaline mouth washes are good, such as listerine, boric acid, or hydrogen peroxide.

9. Goiter.

"Big neck," "hairless lambs."

This is a disease found in many localities of the Northwest, and along the Columbia river basin, assuming almost the appearance of an enzootic.

Cause: Not definitely known, but the theory of a lack of mineral salts seems the most plausible.



Goiter in Lambs.

Dr. Howard Welch, of the Montana Experiment Station, who has had wide experience in dealing with the malady, gives the following clear description:

"Goiter in newborn lambs occurs sporadically in nearly all sheep-breeding districts, but it is enzootic in certain sections of the Northwest, and has at times seriously interfered with the sheep production in those areas. The cause of the enzootic type of goiter is as yet obscure, but it is evident that either a lack of iodin in an available form, or the presence of some agent that interferes with the assimilation of iodin by the thyroid gland is responsible.

"The newborn lambs have a goiter from the size of a hen's egg to the size of the closed fist, and about two to three per cent of these lambs live to maturity, many being dead at birth and others living twelve to twenty-four hours. The lambs with large goiters have the typical appearance of myxedema: thin or wholly absent wool, thick, pulpy skin on head and neck, and short brittle hoofs. Analysis of the thyroid gland shows barely a trace of iodin. When goiter in lambs occurs in any section to this extent, inquiry will reveal that hairless pigs, goitered and hairless calves and weak colts also occur.

"Fortunately, the control of goiter is relatively simple. Administration of potassium iodid in 1 to 2 grain daily doses to the ewes, during at least half of the pregnancy, will entirely eliminate the trouble. The minimum dosage that will prevent goiter has not been established, but the expense at one grain a day is nominal, and a large number of sheep-raisers have gained complete relief from goiter in lambs by the use of this treatment. The details of the method of administration of the potassium iodid vary with conditions. It may be mixed with salt, with grain, or dissolved in drinking water. An increased dose given once or twice a week is apparently as effective as the daily dose."

10. Pustular Eruption of Lambs.

This is a rare but fatal disease of lambs.

Symptoms: These resemble those of foot-and-mouth disease very closely and experience is required to differentiate. It seems to be contracted from a form of gangrenous mammitis in the ewe, and is very infectious.

Treatment: Mainly quarantine and segregation of the infected. The ulcers on the lips of the lambs and the udders of the ewes may be painted with silver nitrate.

11. Tetanus.

This is very prevalent on the western range, following castration, docking and ear marking. It has been considered on page 113 in the section on Acute Infectious Diseases.

12. Colic.

"Stretches"; belly-ache.

Considered under the section on Diseases of the Digestive System, page 156.

13. Constipation.

Costiveness.

For further treatment see page 155.

14. Umbilical Necrobacillosis.

This is a form of navel-ill in which the Bacillus necrophorus is the exciting factor. It is rather rare, and in all outbreaks among lambs where a heavy loss is sustained, a careful bacteriological examination should be made for this organism. Mack of Nevada has described very clearly the clinical picture, and states that as high as 70 per cent of lambs in one band have succumbed.

Treatment—As this is a highly contagious malady, stringent quarantine measures, together with isolation and disinfection should be carried out.

15. Toxemia.

A rather rare and baffling malady found among lambs after weaning, and sometimes occurring in the great pea-feeding sections of the country.

It seems to be a form of forage poisoning or a toxemia caused either by the peas or by some mold found on them.

As the exact cause is not known, or no successful lines of treatment worked out yet, it is mentioned merely to differentiate it from true hemorrhagic septicemia.

The prophylactic measures would be an immediate change of feed, and also of quarters.

CHAPTER XX.

DISEASES OF THE EWE.

In the western sheep-raising sections it is remarkable how small the loss is among breeding ewes. This is largely due to constant culling out the ewes that prove to be poor milkers, or that have difficult parturition; those subject to mammary troubles, and those that lose their lambs. It is a "survival of the fittest" with breeders aiding nature in the selection. Coupled with this is the active life that the ewes lead during pregnancy.

Small bands of sheep, kept under artificial conditions, are the commonest victims of this class of disorders. Lack of exercise, with rich, concentrated foods, play an important part in predisposing to this as to other diseases. These factors, combined with exposure and spoiled forage, are by far the greatest hindrances to success with pregnant ewes. The man who cannot, or will not, recognize these should retire from the sheep business, or, better still, never embark in it.

Ewe Colic.

Often, a few weeks before lambing, ewes will exhibit symptoms of colic or "stretches." These attacks may last for several hours, and victims show signs of crampy pains. The clinical symptoms are usually restlessness, twisting around, lying down and gritting the teeth. This is usually due to indigestion, with resultant tympanites. In case it persists for any length of time, malposition of the fetus may result.

Treatment is symptomatic, and it is recommended that the patient be isolated from the rest of the band, to avoid injuries from being stepped on or from other rough treatment.

Prolapse of Vagina.

This is sometimes seen several weeks before lambing. It may be a simple eversion, or may be due to some growth, as a polypus. The visible symptoms may range from a small red portion the size of one's fingertip, to that of one's hand. Unless promptly attended to, gangrene takes place with fatal results.

Treatment: As the cause is usually constipation, this should be corrected. A careful examination should be made to ascertain if any complications are present.

The parts can be bathed with a warm saline or Burow's solution and replaced. If indicated, stitches can be taken in the vulva, or a small, easily detachable ring inserted. Anointing the parts with belladonna ointment, and keeping the hind parts raised, is of benefit in simple cases.

In all cases, a doubtful prognosis should be made, as the patient may succumb from a very light shock.

UNICORNOUS EWE.

1. Nymphomania.

Excessive sexual excitement; satyriasis.

Very seldom seen in ewes except as a prodromal symptom of rabies.

2. Disorders of Gestation.

Eliminating spoiled forage or bruises that cause abortion, very little trouble is met with in the pregnant ewe.

3. Abortion.

Three types are recognized, the first one being the most common:

Sporadic or accidental, due to some injury or the ingestion of moldy food. Upon a careful examination of the food for evidences of mold, ergot, pitch or other toxic ingredients, the cause will usually be found. The treatment is removal of the exciting cause. Large doses of intestinal antiseptics or viburnum prunifolium are indicated in those threatened with abortion, together with clean, laxative food and absolute quiet.

Enzootic abortion, due to some infectious disease, such as blackleg, scab, pneumonia or rabies.

Contagious abortion. This is so rare among sheep as to merit but little attention. When it does occur, quarantine measures constitute the only successful means of prevention known. The symptoms are similar to those of contagious abortion in the bovine.

4. Dystocia.

Difficult lambing; difficult parturition.

Usually seen in young ewes lambing for the first time, and is due in the majority of cases to a pair of lambs entering the pelvic channel at the same time. They become tangled up in such a way that the most painstaking skill is required to "unravel" them.

First, restrain the ewe in such a manner that she will be powerless to strain. This may be accomplished by two assistants elevating the animal by holding the hands under the flanks. Have the animal face a corner so she cannot creep away on her front feet.

With the fingers cleansed and disinfected, form them into a cone. For a lubricant as well as a deodorant, one part of oil of eucalyptus in sixteen parts of raw linseed oil is very good. If the lambs are dead, injecting a lysol solution into the vaginal cavity will mask the odor. Repel the lambs, and lubricate the vaginal canal thoroughly. Now rotate one lamb until as near a normal presentation as possible can be obtained. A small piece of twine or rope can be attached to the feet, and with traction exerted slowly and carefully, the lamb may be extricated.

When the lambs are taken away, the uterus may be flushed with a good antiseptic solution, and the ewe let down. If she is very weak, a stimulant should be given, and a warm blanket thrown over her. Many a valuable ewe can thus be saved. Unfortunately the veterinarian's fee for services in cases like this is ordinarily more than the animal is worth. This low value of the ewe is the greatest hindrance to the handling of parturient cases in sheep. Under certain circumstances it might be well for veterinarians to make some special arrangements, as to charges for this work, with the owners of bands where a large number of ewes are to lamb at about the same time.

5. Prolapsus of Rectum.

When seen in ewes due to efforts in labor, combined with constipation, the parts should be bathed with warm salt water; in olive oil injected, and the parts then covered with:

℞
Acetatis Plumb.
Flext. Stramonii.
Aquæ q. s.
Sig. Apply three times daily.

The hind parts should be kept slightly higher than the rest of the body; the animal given laxative food, and, in case of great expulsive efforts, one-quart grain morphine may be administered. Belladonna ointment may be applied, but being oleaginous, it soon runs off.

6. After-pains.

After-pains sometimes occur in ewes, and may lead to violent straining, eversion of the uterus, and death from shock.

Treatment: Inject warm salines into the uterus; elevate the hind parts, and administer one-eighth grain morphine and one-twentieth grain atropin. If much weakness is present, camphorated oil may be given.

7. Decomposition of the Fetus.

In many cases a veterinarian is called upon to pass judgment as to whether or not a ewe is pregnant, and, if so, if the fetus is alive or dead. In some instances, this is a very puzzling question.

In situations where the soil is highly impregnated with limestone or other mineral salts, one should always guard against the mistake of looking for a vaginal or fetid discharge in case of a dead fetus. Mummifications are often present under such conditions, with not a single external symptom visible.

When a ewe has a fetus die within her, and barely pulls through the ordeal with her life, it is a good plan to advise fattening for the market. Adhesions often prevent future normal parturition.

In cases of putrid fetuses in the uterus, flushing with strong antiseptic and deodorants, and a small capsule containing twenty grains of potassium permanganate and several drams of boric acid may be introduced into the uterus with advantage.

The udder should be attended to, for a violent mammitis, commonly known as "blue bag," may take place. Milk out the udder and apply belladonna ointment.

8. Preparturient Paralysis.

The report of the California Agricultural Experiment Station for the year ending June 30, 1919, contains the following:

Preparturient paralysis of ewes has been investigated by veterinarians of this station. It attacks fat ewes several days before due to lamb. The cause of the disease has not been definitely determined, but lack of exercise and over-feeding are no doubt primarily responsible for the trouble. The affected ewes are dull, listless and aimless in their movements. In advanced stages there is loss of vision, staggering gait or inability to rise. After five to eight days of illness, death usually occurs.

Prevention has been successful and consists in avoiding conditions that make for the excessive deposition of fat. This can be done by limiting the amount of dry feed given to ewes during the last month of pregnancy and making them rustle for their feed to give them plenty of exercise. Grazing in pastures containing green feed for one or two hours a day will provide succulent food and exercise at the same time.

The ill effects of heavy feeding and lack of exercise are not always confined to the ewes. When sheep in fat condition begin to die, it is usually advisable to move the animals and to change and reduce the feed.

9. Displacement of the Uterus.

The common term for this ailment is "down-fall of the lamb-bed," which includes all the ailments of the womb from the layman's standpoint.

Three serious conditions may affect the uterus:

(a) Hernia or rupture of the prepubian tendon.

(b) Torsion or twist of the uterus when pregnant. Fairly common in the ewe.

(c) Deviation of the uterus or complete eversion.

Very little can be done to alleviate these conditions. As a rule, they are too far advanced to be treated when expert assistance is called.

10. Eclampsia.

Milk disease; milk sickness.

Under this heading is considered parturient paresis, corresponding to the condition of the same name in the cow—the well known "milk fever."

Symptoms: After a normal parturition, and suckling the lamb, the latter dies or is taken away. Within a day or two the first symptoms appear. There is loss of appetite and rumination. The ewe ceases to mourn the loss of her young, and the eyes grow glassy. Coma takes place, and the characteristic symptoms of milk fever in the cow are present.

Treatment: This must be given promptly, and no medicine must be administered by the mouth. One dram of chloral hydrate well dissolved in lukewarm water may be given as a rectal injection, or one-eighth to one-fourth grain morphin given hypodermically. Atropin, in one-tenth grain doses, may be tried. Inflating the udder, if at all possible, should be tried.

11. Metritis.

Inflammation of the womb or uterus.

When this condition occurs, uterine injections of antiseptic, stimulants and blood tonics should be given. There is very little satisfaction in treating this condition, since, due to previous neglect, the case is usually hopeless at the time the veterinarian first sees it.

12. Mammitis.

Inflammation of the udder; blue bag; caked bag; mastitis.

A rather common ailment in the spring among a band of ewes.

The common treatment is to slash the udder open with a knife, and, if the poor ewe lives through this, to fatten her for the market. By humane methods and a little missionary work, much suffering among ewes may be averted by the veterinarian.

Dissolve a half-pound Epsom salt in a quart of hot water, add an ounce fluid extract phytolacca to this solution; place the animal on her back, and with flannel or cotton, dipped in the solution, apply to the udder. In a few minutes the change will be remarkable. Bathing the udder with the warm solution seems to relieve the intense inflammation. If the lamb is alive, allow it to suckle, as the bunting seems to massage the udder and aid in its restoration to normal. A tablespoonful of the phytolacca may be administered twice daily for several days with benefit. If the lamb is dead and the ewe is to be dried up, belladonna ointment or camphor and lard should be applied.

13. Cracked Teats.

Sore teats; fissured teats.

Usually seen in ewes trailed over rough ranges, as the lamb's sharp teeth rarely injure the teats in sucking.

Treatment: Ascertain and remove the cause, if possible. Either of the following ointments may be found useful:

℞
Ichthyoli.
Lanolini.
Glycerini aa...ʒii
Ol. Olivae q. s. ad...℥iv
M. f. ungt.
Sig. Apply twice daily.

Or take equal parts glycerin and castor oil, add enough subnitrate of bismuth to make a paste, and apply several times daily. In case of obstinate fissures, touching up with an aqueous solution of thuja or one per cent solution silver nitrate is good to start the healing process. Then paint with compound tincture of benzoin several times daily.

14. Abnormalities of the Milk.

This is not a common condition among ewes. It is not so important as with the dairy cow. Still, one is often questioned about it, and the following is given for information:

Agalactia or absence of milk. This is a symptom, and one of the first symptoms of disease in a milking ewe. A form of infectious agalactia has been observed among ewes and goats. It is of unknown origin.

Watery milk. This is due to an absence of fats and casein; the milk is of a bluish color. By changing the food and administering tonics, the condition may be improved.

Fatty milk. This is found among ewes that have been fed on rich, concentrated foods, such as oil cake, and in ewes suffering from lack of exercise. Diarrhea ensues among the lambs. The treatment is less food, more exercise and an abundant supply of water.

Curdling milk. A symptom of indigestion, mammitis, poisoning, overheating, and of advanced pregnancy. To alleviate this condition, a tablespoonful of sodium hyposulphite may be given once daily.

Fermenting milk. Cause and treatment same as above.

Putrescent milk. Caused by an invasion of bacteria in the udder. Treatment is the same as for curdling milk, or fattening for slaughter.

Slimy, stringy and soapy milk. Caused by fungi and bacilli. Rather rare. Treatment similar to that for curdling milk.

Blue milk, due to the Bacillus cyanogenus.

Red milk, caused by the Bacillus prodigiosus.

Yellow milk, caused by the Bacillus synxanthum.

Foreign matter, such as dirt; abnormal taste, arising from certain foods, as carrots; drugs, as turpentine and asafetida; germs, such as are found in gangrenous mammitis, and blood, may all exist in milk.

15. Sterility.

A long scientific treatise on sterility in the ewe would prove not only impractical but tiresome. The common and best method is to fatten all ewes that prove to be non-breeders. Due to the small vaginal canal of ewes, manual examinations are difficult, and even when made often nothing abnormal can be noted in non-breeders.

CHAPTER XXI

DISEASES OF RAMS AND WETHERS.

The greatest source of pathological conditions in bucks and wethers is lack of exercise, irregular feeding and excessive fat. Due to a lack of clinical symptoms the diagnosis of these diseases is very difficult, and without a clear, frank statement as to history and hygiene, one may not be able to determine anything about the true condition.

In all cases, a change of quarters, food and water, with abundant exercise is indicated.

1. Gravel.

Urinary calculi cause serious disturbances in rams and wethers, due to the very small caliber of the male urethra, which is only one-sixteenth of an inch in diameter. It has been noticed that the extensive feeding of sugar beets and mangels will cause gravel, and many animals have been lost from this disorder.

Symptoms: The manifestations of this ailment are very pronounced, though rather hard to differentiate at the onset. There is sudden loss of appetite; colicky symptoms, with an urinous odor on the breath. Unless slaughtered, the animal soon dies.

Treatment: Prevention is chiefly to be sought. Mixing a little sodium bicarbonate with the food several times a week is beneficial. Withhold sugar beets or mangels from male sheep.

2. Hernia.

Rupture in sheep usually is not diagnosed until after death. It is a rather rare but fatal condition. Only in valuable animals is an operation advisable.

3. Bloody Urine.

This condition is merely a symptom of some primary ailment, such as arise from injuries, gravel, poisons, roots or moldy silage.

Treatment: Symptomatic treatment is about all that can be given. It must be aimed at the causative factor. Whole flaxseed jelly in teaspoonful doses given in bran and oats is soothing to the urinary organs.

4. Impotence.

Sterility in the ram usually means fattening for market, as it is not profitable to experiment with a sterile ram. Sometimes finding this out is rather expensive, and it is a good plan to "try" several ewes in heat early in the season before turning the ram into the flock.

It is commonly due to lack of exercise. Range bucks for this reason suffer but little from this condition. Medicinal treatment, if attempted in a valuable animal, must be subordinated to exercise to achieve any results. Damiana or yohimbin in small, repeated doses, together with nourishing, but not too concentrated food, may be beneficial.

Stone in the bladder; calculi.

5. Lithiasis.

See page 190.

6. Masturbation.

Onanism; self-abuse.

Occasionally seen in bucks, due to obesity, lack of exercise and unhygienic care, such as not clipping off tags of wool over prepuce.

Slaughter is indicated.

7. Orchitis.

Inflammation of the testicles; congestion of the scrotum.

This is seen sometimes in bucks during the breeding season or immediately following. Bruises, disease, excessive sexual excitement or frost bite are among the common causes.

In extensive inflammation, the functions of the testicles may be so impaired that treatment is hopeless. If gangrene follows, castration must be promptly performed, and that otherwise simple operation may be attended with serious and even fatal results.

Treatment: A suspensory bandage should be applied, lined with cotton, upon which the medicines may be placed.

Four-ounce doses of Epsom salts should be dissolved in a pint of lukewarm water and given once daily for several days. A teaspoonful fluid extract phytolacca may be added.

Local applications to the scrotum will be found soothing in the first stage, of which several of the following are typical:

℞

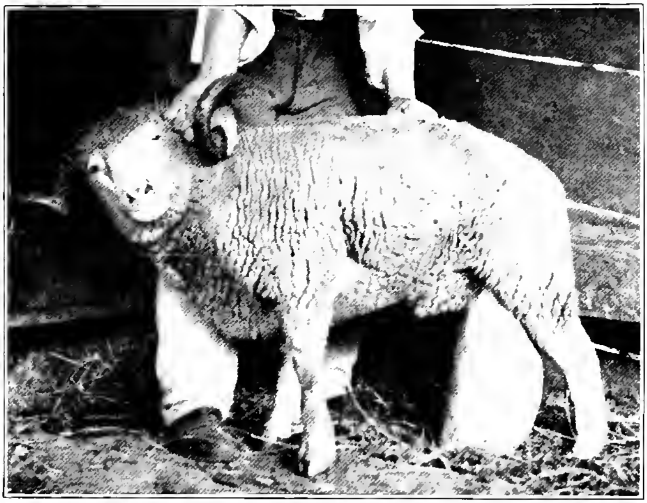
Flext. Stramonium.
Plumbi acetatis aa.......................................ʒii
Aquae q. s. ad..℥viii
M. f. sol.
Sig. Apply with cotton in bandage.

℞

Guaicaicoli ....ʒii
Lanolini q. s. ad..℥ii
Apply to parts three times daily, rubbing very little.

Belladonna ointment, mercurial ointment or phytolacca ointment may also be applied, and dram doses of potassium iodid may be given once daily.

The animal should be removed to a quiet place, and laxative, nourishing foods, such as bran, flaxseed, whole oats and roots fed.



Sheep affected with inguinal hernia. Parts of both the small and large intestine had passed down into the tunica vaginalis, where they had remained so long that the weight had distended the scrotal sac until it rested on the ground.

Abscesses must be treated surgically, and autogenous bacterins may be administered with good results.

8. Balanitis.

Inflammation of the glans penis. This may occur from bruises, filth, calculi or burrs in the wool.

Treatment: Cleanse the parts thoroughly with lukewarm water and castile soap. Paint the glans once daily with an aqueous solution of thuja, or inject into the prepuce any mild antiseptic, such as a saturated solution of boric acid, one per cent zinc sulphate, or ten grains protargol to the ounce of distilled water. A weak solution of sheep dip may be used if nothing else is available.

CHAPTER XXII.

SURGICAL DISEASES.

Surgery in the sheep has been of the "rough and ready" sort, to which the patient was as likely to succumb as to the original disease or ailment. Also, the value of the animal, except in the case of pure-bred animals, has never been enough to justify expert assistance.

The sheep, like the ox, is very resistant to pyogenic infection, and if in good condition soon recovers from surgical interference when performed skillfully.

1. Diseased Teeth.

Often supernumerary teeth are found that interfere with rumination and cause the adjacent teeth to decay. Extraction is indicated, and can be performed with a small pair of "wolf tooth" forceps.

"STUNTS" WITH THE LARIAT.
The sheep camp is often located 50 to 100, or even 300, miles from the home ranch, and the camp tenders engage in lariat throwing contests to break the monotony.

2. Concussion of the Brain.

This is comparatively rare, taking into consideration that the chief method of defense is butting. On the western range, many cases are seen among lambs in the mountainous district, caused by rocks rolling down the mountainside and hitting them on the head.

Symptoms: More or less vague, unless one knows the history of the case. The animal seems in a stupor, while the respirations are small and rapid. Later, the animal becomes weak, assumes a staggery gait, and paleness of the visible mucous membranes is noticeable.

Treatment: Medical interference in these cases is contraindicated, for a drench will enter the lungs. Dashing cold water on the head, and allowing the animal perfect quiet is about as good as any treatment known.

Sterile ethereal camphorated oil, atropin, glonoin or ether may be given hypodermatically.

3. Abscesses.

Abscesses are rare in sheep, but sometimes may follow shearing. Curetting and irrigating several times with a mild astringent antiseptic, such as one dram potassium permanganate and two drams powdered alum to four ounces of water, is a beneficial treatment.

In summer one ounce of lysol to seven ounces kerosene makes a good fly repellent and healing lotion.

There is no successful treatment except castration, and if the bucks are running in large bunches, they should be segregated, given less feed and made to rustle for a living.

4. Injuries.

These consist mostly of bruises caused by shipping or crowding, or by predatory animals.

Often the animal is injured far more seriously than external indications show, and despite the best treatment dies from some internal disturbance.

Dressing the injury with tincture of iodin and applying a dry dressing, together with a stimulant, is about all that can be done.

Where large areas are torn, compound tincture of benzoin makes a good dressing, as it adheres to the parts.

5. Suturing.

Very rarely performed in sheep, although in lacerated wounds such as animal bites, it may be satisfactorily done. With the muscles and skin brought into apposition and held there healing will take place much earlier than otherwise.

6. Rumenotomy.

Removal of the contents of the rumen or paunch.

This is rarely performed, although it has saved the lives of many bloated sheep.

Textbooks give elaborate directions for performing this operation, but in actual practice if one were to follow them out, the majority of sheep would be dead before the contents of the paunch were removed.

If there is time, an area the size of a man's hand on the left flank should be clipped, and tincture of iodin applied. An incision, running parallel with the last rib, and several inches long is then made. The contents are removed as rapidly as possible, the walls of the paunch sutured, and the skin brought into apposition with several interrupted sutures. Tar is smeared over the wound, and in several days the skin sutures removed.

Sheepmen not infrequently perform this operation with a pen knife and a piece of string for suturing material, and even under these conditions the operation often proves successful.

7. Puncture of the Bladder.

Frequently bucks and wethers are troubled by urinary calculi, which sooner or later close up the urethra and prevent the passage of urine. Surgical textbooks give elaborate procedures in these cases, but after one has tried it several times on sheep he will desist. So many animals "die getting well" that the operator gets no credit.

8. Genito-Urinary Infection.

A recent report of the California Agricultural Experiment Station contained the following on this subject:

"An affection of bucks which manifests itself chiefly by marked enlargement of one or both testicles. A number of cases were examined by Hart and postmortem examinations showed that the testicles were not the only parts affected in all cases. Marked changes were found in the kidneys, bladder, prostate glands, urethra and penis. The infection progresses to the point of pus formation and necrosis of soft tissues. In some cases the entire testicle is destroyed. Cultures made from the affected areas on blood agar developed an organism which proved to be *Bacillus pyogenes.* This organism injected into the testicle of a healthy buck produced a slowly-progressing inflammation accompanied by pus formation similar to the naturally infected cases."

9. Fractures and Dislocations.

It is remarkable how few broken limbs or even dislocated joints occur among sheep. Grazing on precipitous cliffs that defy any human being to climb, jumping across narrow ravines, or even running headlong down a steep bluff, few accidents occur, and these are usually among lambs.

The treatment of fractures in lambs is simple. First, dust boric acid or talcum powder over the affected part. Apply an inch layer of cotton, over which lay half a dozen wire or wooden splints, after adjusting the ends of the bones. Bind with gauze bandage, not too tight, allowing for future swelling. The lamb can be carried along in the camp-tender's wagon, for several days, and it is amazing how soon it recovers the use of the limb.

Dislocations, sprains, bruises and twisted joints are rather difficult to treat, rest being the most important factor. Applying saturated solutions of magnesium sulphate, and later, a solution composed of two drams fluid extract belladonna and one dram lead acetate in half pint of water, will often prove beneficial. Sometimes iodin compound ointment is beneficial. Blistering medicaments are not indicated.

10. Amputation of the Claws.

This is often necessary in foot-rot, and consists in cutting away the diseased part with a sharp knife. Tincture of iron, creolin, balsam of Peru or any good antiseptic may be smeared over the part. Balsam of Peru gives splendid results, but is rather expensive for sheep.

11. Panaritium.

Canker of the foot.

Sometimes brought on by bruises and consequent infection by the Bacillus necrosis; also by excessive damp weather and ranging in low, marshy pastures.

The treatment is largely hygienic; removal from the damp or infected quarters, and driving through a trough containing several inches of blue vitriol solution—one pound to five gallons of water, or even stronger. In very severe cases, one dram of formalin to two ounces of glycerin, or a paste composed of equal parts of flour and chlorid of zinc, may be applied with much benefit.

12. Tumors.

Cases are on record of sarcomas and melanomas among sheep, but they are very rare, and, as well known, incurable. A correct diagnosis in cases of swellings, indolent ulcers and sores is essential to avoid useless medication.

CHAPTER XXIII.

DISEASES OF THE EYE AND EAR.

Sheep seem peculiarly prone to eye troubles, and these are principally due to injuries, infection or dust.

Anyone who has ever attempted it, knows how difficult it is to make an examination of the ovine eye. This may be simplified by inserting a grain tablet of urea and quinin hydrochlorid in the inner canthus, and waiting for an hour or so. This will often be the only treatment needed for oat hulls, particles of barley beards, or other flat objects adherent to the cornea.

Lambs and long-wool sheep seem more subject to eye diseases, and in a band of sheep where many are affected, contagion should always be suspected, and proper measures taken for disinfection and isolation.

"Burnt-over" Areas Afford Good Forage for Sheep.

1. Conjunctivitis.

This is usually due to constant irritation. The conjunctiva is greatly swollen, and in advanced cases, pustules may be found.

Treatment: Open pustules, and touch with a two per cent protargol solution. Remove source of irritation, and apply a warm solution of boric acid (saturated solution) several times daily.

Unless securely restrained, sheep are very difficult to examine. The animal should be backed into a corner, and with the herder holding the head so that the eye is on a level, saturate a small swab of cotton with the solution warmed to body heat, retract the lower lid, and drop medicine in. A grain of cocaine to two ounces boric acid solution is soothing in all eye troubles.

2. Corneal Ulcers.

These are small, thickened areas on the cornea, usually just inward from the pupil. Later, they may become a yellowish white.

Treatment: Touching the ulcer with subiodid of bismuth or calomel with a small camel's hair brush several times daily will usually prove beneficial.

3. Keratitis.

Inflammation of the cornea.

This may be sporadic or may assume an epizootic form. It may be caused by turned-in eyelashes, or locks of wool; the epizootic is from infection. The cause of the latter has not been fully worked out, but the condition assumes a very serious form within a few hours.

Symptoms: The eye assumes a milky, congested color. The whole eyeball seems covered with a light scum, and the blood-vessels may be greatly inflamed. There is great lacrimation, and the animal continually moves its head, as though suffering intense pain.

Treatment: In severe cases, the inflammation and congestion is so great that examination is almost impossible. In this case, insert quinin and urea hydrochlorid, or a strong solution of cocaine, to reduce the irritation.

Ten per cent solutions of protargol or argyrol can then be used. If this is unsuccessful, silver nitrate solutions (two per cent) may be used. After the symptoms have subsided, but the lashes continue to stick together, apply yellow oxid of mercury ointment once daily. For the "spots" that remain, treat as given above in corneal ulcer.

In stubborn or epizootic forms, the use of an autogenous bacterin is recommended, particularly where there is much suppuration.

4. Wool Blindness.

Many cases of "blindness" occur among sheep, particularly in Cotswold bucks, due to locks of wool covering the eyes.

Treatment consists in clipping these locks, and keeping the animal in a darkened shed for several days.

Any of the mild antiseptics, such as a four per cent boric acid solution, or five grains of zinc sulphate to a couple of ounces distilled water, may be applied several times daily.

5. Entropion.

Turning in of eyelid.

This is rather common in long-wool breeds. The eyelashes cause intense inflammation, which later may develop into blindness.

Treatment: Surgical. This can be performed only by an experienced veterinarian. The wool should be clipped over the face or there will be a recurrence of the trouble.

6. Ectropion.

Turning out of the eyelid.

Commonly seen in the lower lid.

Treatment: Surgical.

7. Canker of the Ear.

This is sometimes seen as an accompanying symptom of lip and leg ulceration; or it may appear alone.

The treatment consists in cleansing the organ, and applying a mixture of one dram formalin to an ounce of glycerin to the affected parts.

8. Injuries to Ear.

These are sometimes seen in valuable animals, where necrosis has set in, due to injuries, ear-marking, or frost-bites.

Surgical removal of the diseased parts, and applying pure balsam of Peru is about as good a treatment as any.

CHAPTER XXIV.

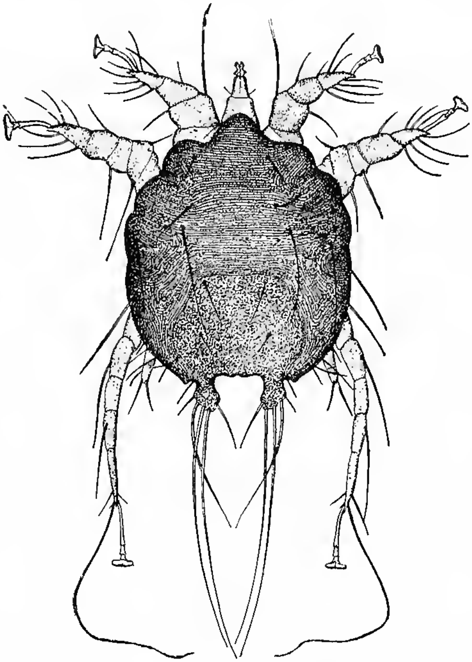
PARASITIC DISEASES.

Experienced men will corroborate the statement that more sheep are lost from invasions of parasites than from all other causes combined, with the possible exception of digestive disorders. Before the days when scab was under control, parasites were, even more than at present, the scourge of the sheep business.

Sheep seem to have little power to resist these pests, and when once infected, not only succumb but spread infection among others. In many instances, the vitality is so lessened by parasitic invasion, that although death does not result, little gain is made in weight or wool because of the devitalizing effect of the parasitic infestation. The animal is in a fit condition to be carried away by trivial diseases, that in perfect health would be resisted with little trouble.

It is of the greatest importance in this class of diseases to quickly discover the inciting cause. This is most vital; treatment of the infected individual or individuals being secondary. Stockmen do not care for finely spun theories or for prolonged scientific explanation of the probable cause of an epizootic among their flocks; they do not appreciate the beauties of science, and care little for the life-history of the pest. What they most earnestly desire and are willing to pay for, is final results. The time to explain how to prevent a recurrence of the trouble is after the epizootic has been brought under control or eradicated.

To avoid disappointment in the treatment of parasitic infestation, the following helpful suggestions of Hall should be heeded: "The determination of the value of anthelmintic medication in practice is not always a simple and certain procedure. Under what we may call barnyard, stable, hog-pen or kennel conditions, it is not always easy to ascertain what worms are passed. There are too many complications. The manure of one animal is mixed with that of other animals, and that of one day with that of other days. The farmer or the stable hand is commonly uncertain as to just what has happened, and neither their observation nor their judgment can be trusted in many cases. The technic of examination necessary in such circumstances is crude and unsatisfactory. Poking in the manure with a stick gives a minimum amount of information. The number of worms passed may be sometimes ascertained or guessed at, if the worms happen to be large ones, but the number left cannot be readily ascertained and the clinical evidence of recovery from a sub-chronic afebrile state of malnutrition and impoverishment, such as is commonly present in clinical cases of parasitism, comes slowly, and such evidence can seldom be sought for by the busy practitioner. Under these circumstances, drugs of but little



Sheep-Scab Mite (*Psoroptes ovis*). Male. Dorsal View, Greatly Enlarged.

(After Salmon and Stiles, 1898.)

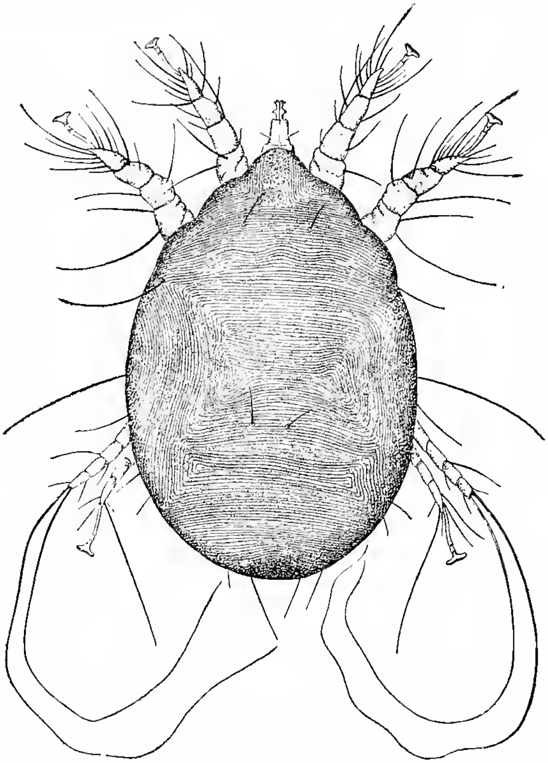
anthelmintic value become established as anthelmintics. Strictly speaking, treatment with such drugs is not practical treatment."

In sheep-raising districts on the western range only five parasites are common: two external, the common scab mite and the sheep tick; three internal, the stomach worm, the liver-fluke and the "gid" or "turnsick."

A. EXTERNAL PARASITES.

1. Sheep Scab.

Common scab; mange; itch; scurf; St. Anthony's fire; wildfire; erysipelas; dry scab; dry rot, and ringworm.



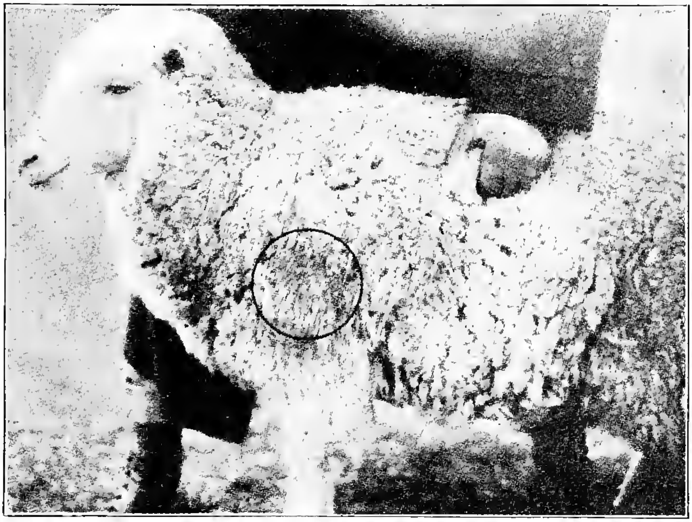
SHEEP-SCAB MITE (*Psoroptes ovis*). Female. Dorsal View, Greatly Enlarged.

(After Salmon and Stiles, 1898.)

Sheep scab is caused by the Psoroptes communis ovis; order Acarina; class Arachnida.

The scab mite is a nearly round, rather light colored parasite, the female measuring about one-fortieth of an inch in length, and the male nearly one-fiftieth. By placing the mites on a sheet of black carbon paper and holding it to the sunlight, they can be seen easily.

After mating, the female deposits about a dozen eggs at the base of the wool fibers. These eggs hatch in three or four days; in a week the young will have matured, and in three or four days more they will have mated and the female laid her eggs. Gerlach estimates that the entire life cycle of the psoroptes mite is completed within fifteen days. Using these figures as a basis, it has been estimated that the progeny of a single pair of mites may attain to the astounding number 150,000,000 in about four months.



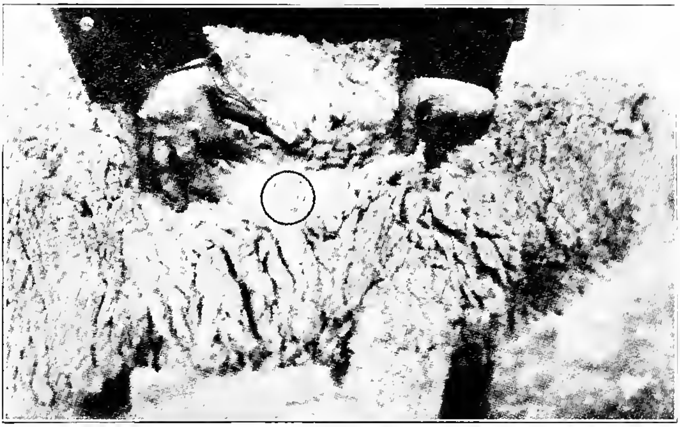
First stage of scab on shoulder, showing natural position of wool disturbed by biting and scratching.

U. S. Dept. Agr. Bul. 713.

Symptoms: To the experienced, the symptoms of scab are very plain. When a sheep becomes infested with one or more mites, small inflamed zones occur where the mite pierces the skin to obtain food. This is followed by itching and the formation of papules, and, as the mites multiply in numbers, the area of inflammation rapidly increases. Serum oozes from the papules, and it is in this stage that the disease is first noticed. When bedded down, the infected animal will get up and bite or rub its body against another or against a tree or post.

The wool begins to get "taggy," and soon commences to fall out. Crusts form on the skin from the dried exudate. It is under the crusts that the mites live.

Depending on the severity of the infection, the disease progresses until the animal never seems to be at rest. It becomes thin; the wool falls out in patches usually along the flanks and back; larger and larger areas of the skin become inflamed and covered with crusts; others become infected, and soon the whole band is one rubbing, biting, scratching mass of distracted sheep.



Characteristic scab lesion in early stage of disease.

U. S. Dept. Agr. Bul. 713.

Differential diagnosis: Practically the only way to become familiar with the disease is to see a genuine case. After that, the diagnosis is comparatively easy.

Wool that has fallen out due to "blue bag" in ewes, or to exposure, leaves a soft, normal skin. There is nothing but a "bald spot" with no pimples, vesicles, papules or inflammatory zones.

Eczema of the various types merely shows a reddening of the skin without the thickening that accompanies "scab."

In sheep work it is always safe to think of scab first, in suspicious cases, and to act accordingly. This will protect the veterinarian and the owner, even if it does put the latter to a little inconvenience.

Treatment: As is well known, dipping and quarantine have nearly eradicated this disease from our country. The subject of quarantines has been taken up in the section on Federal and State regulations.

Dipping with "lime-and-sulphur" has been the mainstay on the western range, the official dip being prepared as follows:

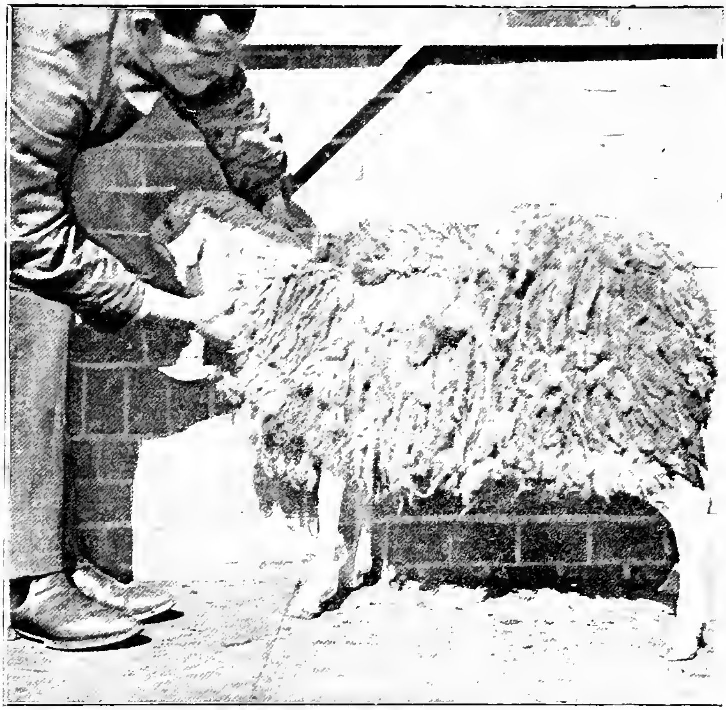
BAND INFECTED WITH SHEEP SCAB.

Unslaked lime	8 pounds
Flowers of sulphur	24 pounds
Water	100 gallons

The lime should be placed in a water-tight box or large bucket, and sufficient water added to make a thin paste. Sift the sulphur in slowly, mixing until about the consistency of mortar. A kettle with 30 gallons of water now receives this paste, and it is boiled for two hours. Water should be added to keep the total quantity up to thirty gallons. It should be stirred well with a mortar hoe, while boiling, to keep the paste from caking on the bottom of the kettle. After boiling for two hours, this "concentrate" should be placed in a barrel to settle, with a bunghole four or five inches from the bottom. If the sediment be mixed up in the dip it will injure the wool, or may harm the eyes of the sheep.

When ready to dip, draw off this clear liquid from the settling barrel into the dipping vat, and add 70 gallons of water, warmed so that the whole mixture is about 100 to 103° F., or in warm climates, several degrees higher.

The size of the dipping vat should depend upon the number of sheep to be dipped, and as minute directions for the whole operation are given in government regulations, this phase of the subject need not be taken up in detail here.



Scabby Sheep.—Note Matted Wool and Bare Spots.

In dipping sheep each one is ducked "head under" once, and kept in the solution for at least two minutes.

In cases where the scabs are extensive, "hand-dressing" should be done to soften the crusts.

There are a thousand and one methods of making up the dip and dipping. In actual practice one soon learns to make the best of facilities at hand, and forget the specific instructions laid down by some person who has possibly never been within a thousand miles of a real sheep camp. The man who is ingenious along these lines, and who can "get along" with the sheep men, is one of the most valuable assets that the Federal or state governments can possess. Unfortunately, merit has been little recognized by either, and officials who have done nothing but antagonize the rank and file of sheep men are kept in localities year after year where their usefulness is greatly impaired if not actually lost. This is one reason why so much enmity exists upon the subject of "scab."

When ticks are present with the scab mites, the tobacco or nicotin dips are probably preferable, for they exterminate ticks better than lime-and-sulphur. These are made up in several different formulae, two of which are given:

Tobacco	30 pounds
Sulphur	7 pounds
Concentrated lye	3 pounds
Water	100 gallons

Steep the tobacco in warm water for about a day, pour off the solution, and add sulphur, and lye and water sufficient to make up 100 gallons. Stir while using, taking the same precautions to keep the dip warm as with the common lime-and-sulphur dip.

The nicotin dip is made up as follows:

Nicotin	Four-tenths of a pound
Flowers of sulphur	16 pounds
Water	96 gallons

Mix the nicotin and sulphur together in a quantity of warm water, and add to the rest of the water in the dipping vat. Keep a close watch on the evaporation, as it may become too strong.

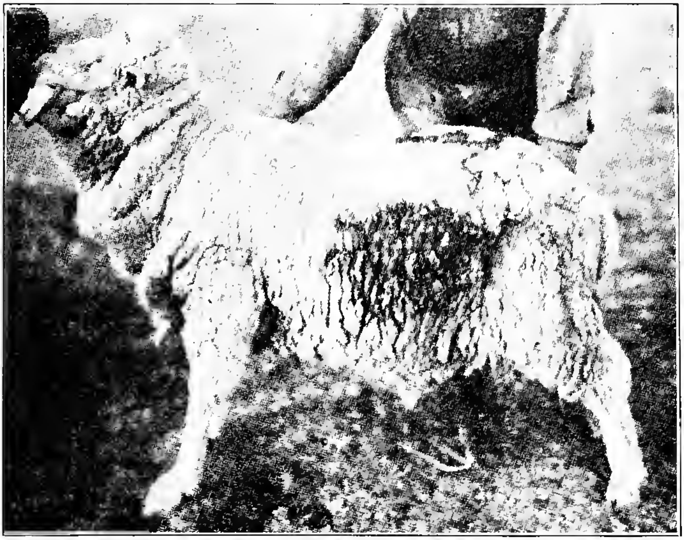
The nicotin solution found on the market contains a statement on the package of the amount of absolute nicotin, and the correct amount to make up the above may easily be figured out on this basis.

In making up dips one should take into consideration the severity of the infection; the weather; the kind of sheep; the hardness of crusts, and the facilities for dipping and heating the water. This requires judgment and experience.

The sediment from the dipping vats is usually diluted and thrown around the corrals or pens as a disinfectant.

Many other dips are used with good success. Coal tars, arsenicals, carbolic acid, potassium sulphid and patent dips are all on the market. Since the war, the prices of certain chemicals have so risen that the old lime-and-sulphur has gained somewhat in popularity.

To eradicate scab from a band of sheep, every member of the flock should be dipped two or three times; kept under close supervision, and at the least symptoms of recurrence, re-dipped.



Scabby buck with entire hindquarters and flank affected. The discolored area is due to dip stain from hand-dressing.

U. S. Dept. Agr. Bul. 713.

The vitality of the mite egg or the mite itself is exceedingly great, although the exact length of life is unknown. However, it is not considered good policy to drive sheep into a corral or pen that has been infested within a year.

2. Head Scab.

Sarcoptes scabiei ovis.

This is the smallest of the three varieties of scab mites. It usually burrows under the skin around the nostrils first, causing small light pimples. The sheep scratches its nose as though infected with the "grub."

This is not a common disease, and "hand dressing" with any good dip will usually clear up the trouble.

3. Foot Scab.

Symbiotes scabiei ovis.

These are rather large mites, and cause irritation on the feet and legs. The symptoms are biting and stamping, with crust-like formations.

This malady is a rare one, and is treated by applying a lather of soap-suds or olive oil to loosen the crusts, and then scrubbing with a ten per cent solution of creolin.

In all forms of scab, of course, the pens or corrals must be disinfected, if the work be done during the winter season.

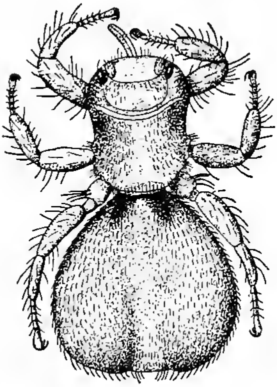
4. Sheep Ticks.

Melophagus ovinus.

This is a six-legged, brownish-colored, mottled parasite, resembling a wingless fly. It spends its entire life on the sheep, the female laying about fifteen eggs, which hatch in about three weeks, the exact period depending somewhat on weather conditions.

While not so destructive as the scab mite, the tick causes a great deal of damage by blood sucking, in lambs, often stunting the growth.

It is not an essentially infectious parasite, as it prefers to stay close to its old home.



Sheep Tick (*Melophagus ovinous*). Male. Dorsal view, enlarged.

(From Curtice, 1890.)

Swingle of Wyoming found that a sheep can be kept free of ticks by keeping a three-foot partition between it and infected animals.

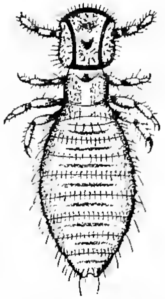
Coal tar or tobacco dips are recommended to eradicate this pest, and two dippings, two days apart, will usually clear up the trouble.

It is the common procedure in the western states to dip the animals after shearing; this is not only beneficial to the fleece but rids the animals of ticks, lice and fleas, as well.

In the West the ticks are very numerous on the sheep in the spring, but after shearing they leave the older sheep and are found principally on the lambs. Later, when the whole band is driven up in the mountains for summer range, practically no ticks are found at all in the band. During the winter they become numerous again, and do an incalculable amount of damage by sucking the blood and causing a constant irritation. To relieve this condition in cold weather when dipping is impossible, one may rub in powdered naphthalin, or lard, sulphur and coal oil.

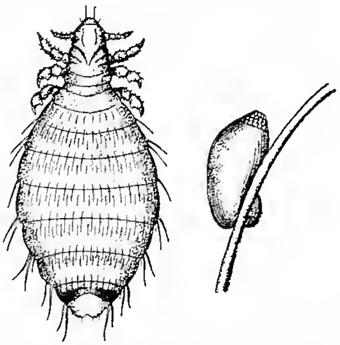
5. Lice.

Trichodectes sphaerocephalus; common sheep louse.



Sheep Louse (*Trichodectes sphaerocephalus.*) Adult female, enlarged.

(After G. Neuman, 1892.)



Sheep Foot Louse (*Haematospinus pedalis*). Adult female and egg, enlarged.

(From Osborn, 1896.)

This is a very small white and reddish brown parasite, measuring about one-twentieth of an inch in length. The eggs are laid at the base of the wool fibers.

Only a very careful examination reveals the true cause of the irritation, as the symptoms are much like scab. In the heat of the day, the lice will be found to be sticking to the outer end of the wool fiber.

If many animals are infected, dipping with any coal tar dip is advisable. If only a few, an ointment composed of equal parts lard and sulphur, rubbed into the affected parts, will soon eradicate the lice.

6. Maggots.

Embryo of the *Musca vomitorium* or common blow-fly.

This is one of the most serious pests with which the sheep man has to contend. When a sheep is accidentally cut during shearing, or receives some other injury breaking the skin, the blow-fly attacks the helpless animal. Sometimes the wool becomes overlaid with fetid discharges, such as urine, feces, or pus, and here the fly lays her eggs. Soon a festering mass of maggots is present, and frequently in a large band is often not discovered until the animal is nearly dead.

Symptoms: In any case of ovine illness, particularly in small flocks, where only one or two are sick, maggots should be suspected, and carefully looked for. The animal may refuse to eat; be dumpish; feverish; finally becoming weak from the extreme sapremia caused by the parasites, lie down and die. Pneumonia, poison, impaction and hemorrhagic septicemia have all been mistaken for simple maggot infestation, and only after eliminating these can one make an accurate diagnosis. The condition is very common in the spring, following shearing, lambing, ear-marking, castrating or docking. The location may be anywhere, but the regions of the thighs, axillae or back are the common parts affected. Sometimes a very small aperture opens into a large pocket containing a handful of the parasites, and can be found only by careful search. A small electric light is useful in making the examination.

Treatment: A solution of one part lysol to seven parts kerosene will quickly bring all the parasites out of the abscess. After this has been accomplished, the solution should be used several times a day to destroy the larvae in various stages of growth. For a healing solution, compound tincture of benzoin or tincture of iodin will be found useful. In large bands equal parts of axle grease and pine tar is excellent. Ether and sweet oil will bring the larvae out, and turpentine can be used after they are all destroyed. The best thing is prevention. In cases of injuries, smear pine tar over the part, or equal parts lard and sulphur. All taggy wool should be clipped.

In cases of extreme sapremia, sterile ethereal camphorated oil administered hypodermically, and small doses of echinacea, echafolta calcium sulphide or any of the blood tonics may be given, combined with good nursing and nutritious food.

Thousands of sheep are lost every year from maggot infestation, and it should be regarded as a serious menace, instead of a trivial pest.

7. Fleas.

Pulex irritans [human]; *Pulex serraticeps* [dog]; *Pulex avium* [bird].

These rarely attack sheep. It is sufficient to merely draw attention to their existence. In certain localities, however, they are very prevalent.

Dusting the animal well with Persian insect powder and disinfecting the pen or corral with creolin or lime will eradicate these pests.

8. Flies.

Under this heading come gnats, sandflies, mosquitoes and other winged parasites. Flies of peculiar economic value to the sheep industry, such as the Musca vomitorium (adult of the maggot) and the Estrus ovis (adult of the grub in the head), have been considered at length under their respective headings.

B. INTERNAL PARASITES.

Fortunately, due to the high altitude of the common sheep ranges in the West, very few internal parasites attack sheep. Only in isolated localities are these found, and then usually in low sections of the country, or in places long devoted to sheep husbandry.

However, in the middle western and eastern parts of our country, internal parasites run riot, and cause untold losses. They not only destroy the animal, but in light invasions, reduce the vitality so that other diseases may gain a foot hold, or decrease the weight and growth of wool.

In the feed-lots of the Mississippi valley, where thousands of western lambs are finished for the abattoir, stomach worms, lung worms, tape worms and liver fluke are common, and when once these parasites gain entrance to the soil, they are extremely hard to eradicate.

Plowing up these feed lots, and using fresh ground each year, will greatly reduce the numbers of parasites. If this is impossible, plow up yearly, and sprinkle liberally with lime. A small amount of sulphur can also be used, and this will prove beneficial to the soil.

Sheep Affected with Gid.

Instead of fighting these pests by "home treatment" until the parasites became firmly established in their corrals, if the average lamb or sheep feeder would consult his veterinarian at the very first indication of trouble, much loss could be avoided.

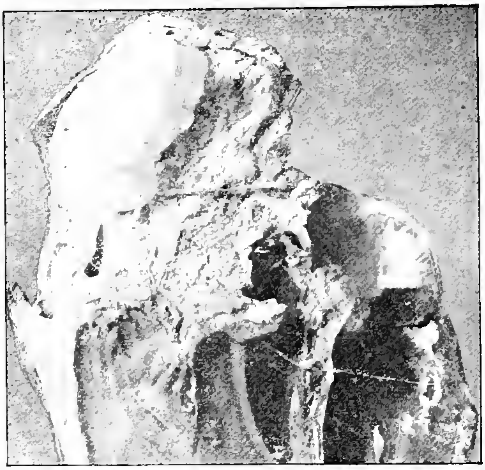
Prevention is far more satisfactory than cure, and before turning in newly purchased animals, it would be a good thing to keep them by themselves for a short period. This voluntary "quarantine" will often prove valuable in keeping down serious outbreaks of disease, and prompt consultation with a competent veterinarian nip the trouble in the bud.

1. Gid.

Sturdy; turnsick.

This ailment is due to the larva or hydatid phase of the tapeworm, the Taenia coenurus.

The eggs of this tapeworm are distributed around the pens or corrals by carnivorous animals, chiefly dogs. Other animals, such as the coyote, wolf or fox, may also be the host of this tapeworm.



Section of sheep brain showing gid worm projecting from center of brain.

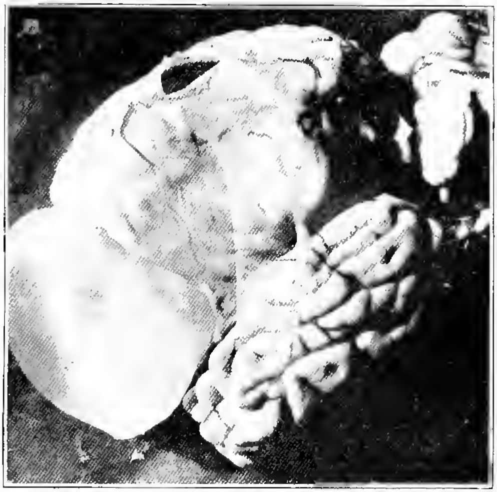
After the eggs are ingested by the sheep, it is supposed that they hatch and the embryos gain entrance to the circulatory system by piercing the walls of the stomach, although our knowledge of their life history is incomplete. Those that reach the brain or spinal cord develop into large cysts, and cause this fatal malady among sheep.

Symptoms: The manifestations of gid are general in character, and at first one may suspect rabies, or some form of poison.

but the coma that soon follows, and an autopsy, will reveal the true cause. The animal becomes dull, with loss of appetite. Later, it begins to stagger around in more or less of a circle, hence the old name, "turnsick." Finally, it falls down and dies in a convulsion.

The fact that there is no sneezing or nasal catarrh in gid differentiates it from grub in the head.

Treatment: This is unsuccessful, prevention being the only logical method to pursue. Treat the sheep dogs with a vermifuge, such as the following:



Brain showing cyst of gid parasite.

℞

Pulv. areca nut	gr. xx
Male fern	ʒi
Turpentine	m. x

M. f. cap.

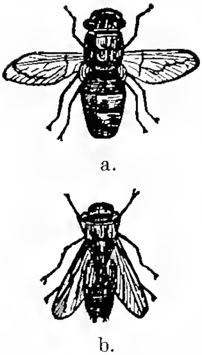
Starve the dog all day, allowing plenty of water. In the evening, give the above, and the next morning administer four tablespoonfuls castor oil. Do not allow the dog to run over the sheep pasture. This is the average dose for a forty-pound dog. Stray dogs are best treated with lead administered with a well aimed gun.

Where sheep are known to be infected, all heads of dead animals should be burned and not fed to the dogs or left for coyotes.

2. Grub in the Head.

Grub; gleet; nasal catarrh.

Cause: The sheep bot-fly, *Œstrus ovis*, deposits living larvae in the nostrils of sheep. These crawl up into the nasal cavities, causing a violent catarrh, and, in severe invasions, death. Loss of weight and lack of thrift always occur. In some localities, they are a very serious menace.



Estrus Ovis.
a. Adult female.
b. Adult male.

Symptoms: These are very pronounced. The infected animal runs around snuffing as though it had something in its nose. The rest of the band keep their noses close to the ground and show signs of fear. Later, the infected sheep lies down, sneezes, rolls its head in every conceivable manner and exhibits the greatest excitement. The eyes grow watery while the nasal membranes are inflamed.

To differentiate from gid is comparatively easy. There is no violent staggering around in a circle, and no disturbance of the functions of the nervous system, the nasal catarrh being the most prominent symptom.

Treatment: After infection, this is practically hopeless. Some good results have been reported by mixing snuff in olive oil and pouring it in the nose, while holding the victim on its back. Wire snares formed of small loops have also been tried.

Prevention is the only logical procedure. Keep the nose well smeared with tar. In a large band, this is done by boring large holes in a plank, smearing the edges with tar, and filling up with salt.

For small flocks, a dark shed should be provided for the animals to run into during the heat of the day. Strips of gunny sacks sprinkled with any coal tar dip may be used as curtains. At the University of Illinois it was found that these strips hung from the ceiling so that they dragged on the backs of the animals, were very efficacious in keeping off flies.

This parasite is a dangerous pest to sheep and should be regarded as such, and the most satisfactory line of procedure will be found in prevention. This should be insisted upon by every veterinarian called in to treat this condition.

3. Lung Worms.

Hoose; husk; snots; verminous bronchitis.

The *Strongylus filaria,* a small, reddish-brown round worm, less than an inch long, and about as thick as a thread, is the parasite responsible for this disastrous disease.

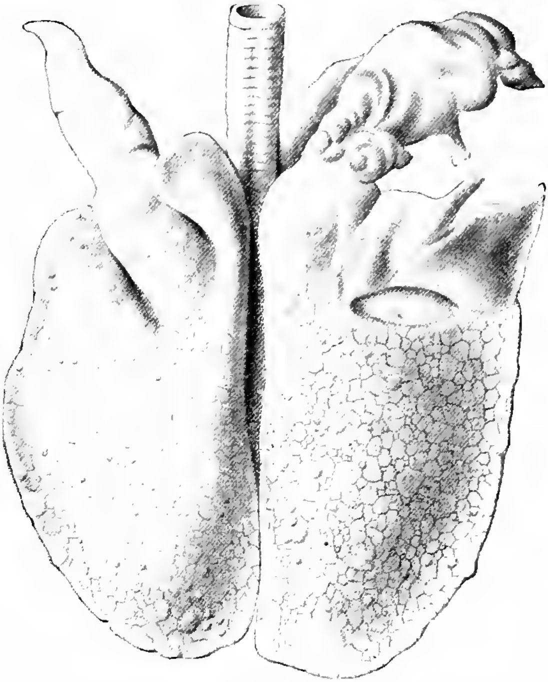
Symptoms: The evidences of this ailment are most pronounced in lambs, and depend upon the number of parasites present. First, there is a pronounced anemia, commonly known as "paperskin." A broncho-pneumonia is next seen, accompanied by a short, hacking cough. The nose is rubbed on a log, and the victim breathes with difficulty. Toward the last, a diarrhea sets in, and the animal staggers around, until it falls to the ground, never to rise.

Professor Ransom of the Bureau of Animal Industry, gives the following valuable data concerning this common parasite:

"The adult worms live in the bronchi and give rise to numerous embryo worms which are coughed up onto the pasture or swallowed and passed out in the feces. After some development, the young worms are apparently swallowed in contaminated food and water and make their way to the lungs. Sheep are therefore infested from food and water, but not from contact with one another. Preventive measures are therefore a matter of clean water supply and of clean pasture. Infested animals should be isolated and either treated or disposed of. Pastures should be drained and kept free from standing water. Wet pastures furnish the most favorable conditions for the development of these and other worms. Fresh clean pasture, pasture rotation, or at least rotation of different kinds of stock on the permanent pastures, are all measures that will aid in keeping down worm infestation.

"Plenty of nourishing food and a liberal supply of salt are important aids in enabling live stock to withstand the attacks of lungworms and other parasites. Losses may sometimes be stopped or minimized by removing stock from pasture and placing them in dry, well-drained yards or stables, maintained in a clean and sanitary condition.

"It is not known how early lambs should be weaned to avoid danger of infestation, but less risk of infestation will be run if the lambs until weaning are kept off of pasture, or if this can not be done, moved frequently to fresh pasture. After weaning also, they should be changed as frequently as possible to fresh pasture, in order to prevent extensive reinfection from the parasites which they are likely to have acquired in small numbers from the pastures, yards, or stables occupied by them in company with their infested mothers.



Sheep Lungs, Showing Nodules and Pseudotuberculous Tubercles, Produced by Lung Worms.

"Treatment for lungworms has usually proved more or less unsatisfactory, but investigators at the University of California claim good results from the following method of treatment:

"Chloroform injected into the nostrils will stupefy large numbers of lungworms and cause paroxysms of coughing which will eliminate some of them. The amount of chloroform to be given varies, but enough should be given to render the animals slightly groggy. Three cc. is the maximum dose for sheep and goats; 5 cc. for hogs; and 11 cc. for calves. There are about 4 cc. in a teaspoonful. A dose of Epsom or Glauber salts should be given two hours after administration of the chloroform. The treatment should be repeated every three to five days until the animals respond. As many as three treatments may be necessary. A fountain pen-filler may be used to inject the chloroform into the nostrils. Tipping the animal's head back facilitates the operation. The nostrils should be closed for a few moments with the hand after the chloroform is injected.

"The foregoing method of treatment has not been tried in this Bureau, but Mr. S. B. Freeborn of the University of California states that he has treated 300 calves and goats without a fatality and with marked success in every case, and he says that others in his state have successfully treated several thousand head with only two reported fatalities."

Lytle of Oregon reports good results from a mixture composed of two parts ether to one of turpentine. Animals should be forced to inhale this until partly anesthetized. A course in worm repellents should accompany this treatment.

4. Stomach Worms.

This is one of the most serious ailments that affect sheep, being especially serious in the young.

Another member of the Strongyles, the *Strongylus contortus*, a brownish colored thread worm, is the cause of this ailment.

This parasite prefers a cool, damp habitat, and experienced observers have pointed out the fact that the infection is usually acquired around shade trees where the lambs play during the heat of the day. On desert ranges, in sandy or volcanic ash soil, very little trouble is experienced.

The life history of the stomach worm, as worked out by Ransom of the Bureau, is as follows, and his description cannot be improved upon:

"During the summer season lambs are liable to suffer severely and frequently die from infestation with parasitic roundworms, commonly known as stomach worms. Loss of flesh, weakness, digestive disturbances, diarrhea or constipation, capricious appetite, and paleness of the skin and mucous membranes of the eyes and mouth are common symptoms. Watery swellings under the jaw are often observed. If an affected animal is killed and the fourth stomach opened and carefully examined, it will be found to contain numerous small worms, one-half to one and one-fourth inches long and about as thick as an ordinary pin.

"The life history of the stomach worm is essentially simple. The eggs, which are of microscopic size, are passed in the droppings of infested animals. Most adult sheep harbor at least a few stomach worms, and it is from this source that the lambs become infected through the medium of the pasture. The eggs in the droppings hatch out in a few hours in warm weather. The unhatched eggs or newly hatched worms are not infectious, but in a week or less in warm weather to three or four weeks in cool weather the young worms develop to the infectious stage and crawl up blades of grass ready to be swallowed by a suitable host, a sheep or other ruminant. They crawl up from the ground only in rainy weather, when dew is on the grass, or when atmospheric conditions are such that the grass blades are covered with a film of moisture. When the worms become dry they cease their activity, but remain on the grass in an inactive condition until the air again becomes overcharged with moisture when they resume their upward migrations. Whether active or inactive they are ready to continue their development when swallowed by a suitable host.

"The eggs and newly hatched worms succumb to freezing or drying, but after the worms have reached the infectious stage they are able to survive repeated freezing and long periods of dryness. They have been kept alive in a dried condition for thirty-five days, and for six months in moist earth. Infection has been found to persist in a field vacated for over seven months; that is, from October to June. It appears quite probable that young worms may develop to the infectious stage on the skin of infested sheep in adherent fecal material, so that there is an evident possibility that lambs sometimes become infected from the skin of their mothers while suckling. So far as known, infection by penetration of the young worms through the skin, which occurs in the case of hookworms, does not occur in the case of the stomach worm; but sufficient investigation has not yet been made to exclude this possibility.

"When swallowed by a sheep or other ruminant the young stomach worms develop to maturity in two to three weeks, and begin producing eggs. The eggs do not hatch in the body, so that no increase in the number of parasites occurs, except as more young worms are taken in from time to time. The adult worms may live for many months in the stomach of their host. In experiments in which sheep were kept on board floors and handled in such a manner that the chances of fresh infection were reduced to a minimum, stomach worms were still present after a year and a half; most of the worms, however, had disappeared.

"It is apparent from the foregoing that the problem of protecting lambs from infestation with stomach worms is a difficult one. As yet no satisfactory solution has been discovered. In view of the rapidity of development of the young worms and their great vitality, the changing of pastures sufficiently often to avoid infection is generally out of the question under practical conditions; but if the sheep are changed to fresh pasture frequently, and if overstocking and close grazing are avoided, the degree of infestation can be reduced to a minimum. Infested pastures and fields which have been plowed and reseeded are comparatively safe when ready again for grazing, but on the other hand, permanent pastures grazed and stocked to their limit, year after year, are particularly dangerous. Moving from field to field at frequent intervals, even though it is not always possible to use fields which have been under cultivation since the last grazing, helps to keep down the number of parasites. Wet pastures should be avoided. Early lambs are less likely to suffer from stomach worms than late lambs, and, furthermore, in northern localities they can be marketed before the season of serious stomach-worm troubles arrives."

Symptoms: The experienced eye will easily detect the symptoms of this disease. Along in July or August, the infected animal begins to hang back from the rest of the band. "Off color," says the herder. Emaciation becomes noticeable, and the walk is hesitating, like a sick person getting out of bed and taking the first few steps. The wool becomes harsh and rough and the lamb becomes very weak. Later, the victim staggers about, keeping from tumbling on the ground by the greatest of efforts. A swelling comes on the lower jaw, just between the angles of the inferior maxillae, while the visible mucous membranes are pale, and the skin like parchment. Depending on the severity of the invasion, death may take place in from two weeks to two months.

A postmortem examination reveals the presence of clumps of reddish-brown worms, about half an inch long, and the size of a hair, living in a brown liquid, in the lower part of the fourth stomach or abomasum.

Treatment: In a small band of sheep, treatment may be instituted with a fair degree of success. The copper sulphate solution has proved the best one yet tried. It should also be remembered that copper sulphate or "bluestone" is a valuable blood tonic to sheep, and this in itself assists in the treatment. The Zoological Division of the Bureau of Animal Industry gives the following clear and explicit directions for this treatment:

"In the preparation of the dose use only clear blue crystals of copper sulphate (bluestone). Crush the crystals to a fine powder when ready to make up the solution. Dissolve one-fourth (avoirdupois) of the powdered crystals in one pint of boiling water, using a porcelain or enamel-ware dish, as the bluestone will corrode most metals. Then add enough cold water to make the solution up to three gallons, using wooden, earthenware, or other non-metallic receptacles. This will make an approximate one per cent solution and will be enough to dose 100 adult sheep, allowing for about a ten per cent waste.

"The amounts of the dosage for both old sheep and lambs are:

For lambs under one year of age	1¾ ounces	(50 cc.)
For sheep past one year old	3½ ounces	(100 cc.)

A glass with marks scratched on the side with a file may be used for measuring the doses.

"The drenching apparatus consists of a small strong rubber tube, about three feet long and three-eighths inches in diameter, a hard rubber, porcelain or enamel-ware funnel, which is fastened to one end of the tube and a brass mouthpiece three-eighths inch in diameter and nine inches long fastened to the other end of the tube.

"Customarily the treatment is given after the sheep have been starved over night, but apparently may be given with equally good results without preliminary fasting, providing the animals are not gorged with feed or water when treated.

"While being drenched the sheep should remain on all four legs with the head held horizontally. This is important for if the head is held above the horizontal (nose higher than the eyes), there is danger of some of the fluid passing into the lungs, thereby causing pneumonia and almost certain death. Measure the amount of the dose in the measuring glass, and then after the drenching tube is in position, pour the dose slowly into the funnel. The metal mouthpiece of the drenching tube should be placed between the jaws in the space between the teeth at the side of the mouth and directed backward, but should not reach farther than the base of the tongue. In order to prevent the sheep from stopping up the end of the mouthpiece with its tongue and thus interfering with the flow of the liquid, the person holding the mouthpiece in the sheep's mouth should give it a rotary motion. This will tend to keep the sheep swallowing, prevent plugging of the tube, and also tend to obviate the danger of the fluid's entering the lungs. The fluid should not be administered more rapidly than the sheep can comfortably swallow.

"Care in the administration of the dose is highly important, as carelessness or any undue haste is liable to have serious results. The copper sulphate treatment, like the administration of medicines in general, is safest in the hands of a competent veterinarian."

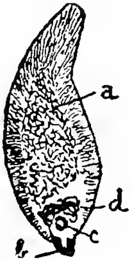
This line of medication has supplanted the gasoline treatment, which was the best thing known for a long time in combating the parasite. After starving the lamb all day, one-half ounce each of gasoline and raw linseed oil mixed in four ounces fresh cow's milk are administered. Repeat this dosage for three evenings, allowing food several hours after giving the medicine. Very weak lambs could be given a little stimulant, such as sweet spirits of nitre, aromatic spirits of ammonia, raw egg and gruels. Ten days later, give another course of treatment.

Prevention of stomach worms is more to be desired than any treatment, however successful. It is best accomplished by frequent change of pasture. In case this is impossible, it is a good plan to go out of the sheep business, for stomach worms and profit do not go hand in hand. Fighting this disease is not only an expensive battle, but an uphill task as well.

5. Liver-Rot.

Distomatosis.

This is a disease of deadly importance in low-lying countries, but is not common to the sheep raising sections of the West. The sheep is naturally an inhabitant of high altitudes; this factor is in its favor, since to a large extent it keeps it away from noxious parasites to which it is so susceptible.



Distoma Hepaticum.
a. Intestines.
b. Oral sucker.
c. Ventral sucker.
d. Uterus.
(From Kinsley's "Pathology.")

Feeders who prepare the best mutton for market, and who buy western lambs that have never lost a feed and that have spent their lives at an altitude of from three to ten thousand feet above sea level, will sustain me in this statement.

Liver-rot is due to the *Distoma hepaticum* or *Fasciola hepatica;* commonly called the liver-fluke.

The life history of the fluke is an interesting one, and may be briefly given as follows: The feces of infected animals contain the embryos which mature in about six weeks under favorable conditions. They then bore their way into the bodies of fresh-water snails, and after passing through certain cycles, emerge as cysts. When these are ingested by sheep in either food or water, they undergo a further development and migrate into the bile duct and on into the liver.

Just how long a period is spent in the liver is as yet undetermined; nor does the sheep-owner care. What he wants to know is how to keep the flukes out of his animals entirely.

Treatment: While liver fluke is generally considered an incurable ailment, many encouraging reports have been made regarding the male fern treatment, and Lytle of Oregon believes it the best line of medication so far devised. This was worked out by Railliet, Moussu and others. The main drawback to its general use, according to Ransom, is its cost. At the present price of male fern, each treatment would cost around fifty cents, not including oil, labor or losses due to treatment.

Two tablespoonfuls of ethereal male shield fern is mixed up in an ounce of mineral oil, and given each morning, several hours before feeding, for five consecutive mornings. In many cases, this even clears the parasite out of the bile duct.

This treatment should be given under the direct supervision of a veterinarian to insure the best results, for the dosage must be varied to suit the condition of the animal.

6. Tapeworms.

Due to their insidious and constant depletion of the host, the subject of tapeworms is assuming more and more importance in successful animal husbandry. This is particularly true of lamb and sheep raising, for these animals have little resistance to parasites.

As a rule, taeniasis in sheep does more damage in winter, and in certain localities is worse than in others. In these, one certain kind of tapeworm will be found, and if this be identified, appropriate treatment can be instituted. Veterinarians are urged to refer to their various zoological departments of state institutions, specimens for identification. There is much to learn about this class of parasites, and their importance has heretofore been underestimated.

The following tapeworms have been found in sheep:

A. Taenia Fimbriata.

Synonym: *Thysanosoma actinioides,* "fringed tapeworm."

This is the most common tapeworm affecting sheep, and is extensively found in the West. Ransom states its life history is not known, neither has a satisfactory treatment been discovered.

Description: The length is from three to five inches. The head has four sucker discs, and each segment is short and wide, and provided with a fringe, hence its name.

Parts Infested: Small intestine, particularly the duodenum, and bile duct.

Symptoms: In general, unthriftiness. When a mass of worms clog up the bile duct they may cause a fatal icterus. An autopsy on a seriously affected animal will be more helpful than any other method of diagnosis.

Treatment: As stated above, no successful treatment has yet been devised. The male fern treatment, as suggested under the topic of liver fluke, might be tried.

B. Taenia Expansa.

Synonym: *Monieza planissima.*

This is the largest tapeworm affecting sheep, and is found in all parts of the country.

Description: When fully developed, it may reach the length of thirty feet or more. The head is provided with four sucker discs, and is very small. The segments are very thin, and are about one-half inch in length.

Parts Infested: The small intestines.

Symptoms: Unthriftiness.

Treatment: As for liver fluke. If large numbers are infested, one may starve the animals all night, and give a tablespoonful of turpentine in an ounce of raw linseed oil. In about an hour, feed may be given. However, a change of range is advised, and slaughter of all infected animals.

C. Taenia Ovis.

The adult tapeworm does not exist in sheep, but its larvae, the *Cysticercus ovis,* does, which see.

D. Taenia Alba.

This is a white tapeworm, two to five feet long, and is sometimes found in lambs.

As with the fringed tapeworm, very little is known about it.

E. Taenia Coenurus.

The adult is found in the dog, while the sheep harbors the larvae, or *Cysticercus coenurus,* causing gid, which see.

7. Threadworms.

A small, threadlike filaria, is sometimes found coiled in the mucous membranes of the esophagus. It is a couple of inches long. The variety infesting sheep is known as the *Spiroptera scutatum or Gongylonema scutatum.* Their names are the most dangerous properties known about them, as they are not bloodsuckers.

8. Sclerostoma Hypostomum.

This is a small, white worm, barely an inch long, and of threadlike diameter.

These inhabit the small and large intestines; are blood-suckers, and occasionally do harm.

9. Hook Worms.

The variety affecting sheep is known as the *Uncinaria cernua,* and is chiefly found in the southern states.

It is a yellowish-white, thread-like worm, and, according to Kaupp, is about half an inch long.

They inhabit the small intestine, and sometimes the large bowel.

They cause about the same symptoms, in a lesser degree, as the stomach worms, and should be treated as suggested under the head of Stomach Worms (see page 221).

10. Round Worms.

The *Ascaris ovis,* a yellowish white round worm, about six inches in length, is found in Europe, but so far, not identified in this country.

11. Pentastoma Taenoides.

This parasite has not been reported in this country, but is common to Europe. It belongs to the tick family, but looks like a worm.

The adult infests dogs; the larvae are found in sheep.

12. Cysticercus Ovis.

Sheep measles; tapeworm cysts.

The cyst of the Taenia ovis, a tapeworm found in dogs, wolves and coyotes, particularly prevalent in the Northwest.

The eggs are passed in the feces by the tapeworm carrier, and may be ingested by sheep. In less than two weeks the parasites have embedded themselves in the muscles of the heart, diaphragm and tongue. It is fully developed in about three months, and is nearly one-half inch long.

Due to the lack of symptoms during life this is of more interest to the meat inspector than to the practitioner. However, by cooperation, affected areas can soon be identified, and means of control instituted. The only practical way to do this is to treat the infected dogs by the following method:

Give the dog supper as usual; pen him up, and allow nothing further. The next day just before noon, give four ten-grain capsules filled with ethereal extract male fern, giving about two tablespoonfuls of milk to dissolve this in the stomach. About an hour later, give four ten-grain capsules of freshly ground areca nut, in several tablespoonfuls of milk. By ten-grain capsules are meant those holding that amount of quinin, and the areca nut must be freshly ground, or it will be harmless to the parasite. To give capsules to a dog, set him on his haunches, grasp the upper and lower jaws firmly, open the mouth medium wide, drop capsules on back of tongue, and slowly pour milk in, which will cause the dog to swallow. Then tie his head up just high enough so he will not choke, otherwise he will vomit the medicine in a few minutes. In about an hour defecation will take place and the feces should be burned.

In from ten days to two weeks this treatment may be repeated.

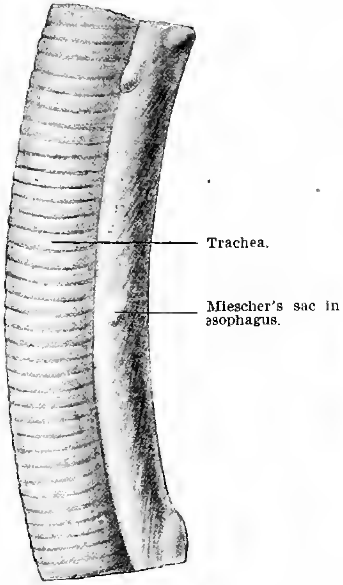
13. Nodular Disease.

This is a rapidly increasing disease in the great sheep-raising districts, and the symptoms are so obscure that the presence of the parasite is not discovered until after slaughter.

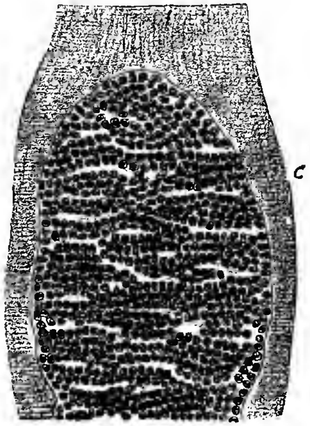
Ransom gives the following valuable data concerning this parasite:

"The parasites causing this disease belong to a species of nematodes known as *Oesophagostomum columbianum.* The adults occur free in the lumen of the large intestine. The eggs are passed in the feces of the host. After hatching, the larvae undergo a certain amount of development, reaching a stage in which they remain until they are swallowed by a sheep, in water or with grass which has been contaminated by the feces of infested animals. The larvae then enter the wall of the intestine and develop further, a nodule being produced at the point where each larva is located. Frequently the nodule grows to a considerable size with the formation of a cheesy mass in the interior. Finally the larvae escape from the nodules into the lumen of the intestine and continue their growth to the adult stage.

"There is no known satisfactory medicinal treatment for nodular worms in sheep. Dalrymple of Louisiana has found that he can practically prevent the infection of lambs with this parasite by raising them in bare lots, that is, keeping them with the ewes in yards which are kept clear of all vegetation. Cut green feed and other fodder is fed in raised racks, and water is furnished in troughs also raised from the ground and protected from fecal contamination. The floor of the yards is kept as free as possible from litter and manure by frequent cleaning.



Miescher's Sacs in Musculature of Sheep Esophagus.



Sacs of Miescher from Muscles.

(After Ziegler.)

"General preventive measures consist in avoiding wet low-lying pastures, changing animals to fresh ground as often as possible, supplying them with clean water, plenty of nourishing food, and a liberal allowance of salt. Animals known to be affected should be isolated from the rest of the flock.

14. Sarcosporidiosis.

Sarcocystis tenella; Miescher's tubules.

A class of minute parasites infecting the muscular tissues of animals, also known as "Miescher's tubules." It is becoming a very common parasite.

Animals grazed in swampy pastures or near a pond seem to be more commonly affected. Later investigations seem to show that other animals may be the distributing agent, the sheep being the definitive host.

No ante-mortem symptoms are recognized, and no treatment nor means of prevention is at present known. Removal to a high, dry range, and watering from running streams might prevent the parasite from gaining a hold in the band.

While the meat of a carcass of mutton affected with this parasite is edible. the numerous hemorrhagic spots render it rather unsalable. The diaphragm, peritoneum and other abdominal muscles are the parts commonly affected.

15. Coccidiosis.

Intestinal *Psorospermosis.*

This is a disease of lambs, often becoming enzootic among animals several months of age.

The cause is believed to be the *Eimeria faurei,* inhabiting the intestines.

The symptoms are a gradual decline, and impossible to differentiate from stomach worm infestation. Only a postmortem examination will reveal the true cause, and this requires a very careful search.

No treatment is successful, prevention being only the practical method of control.

16. Aspergillosis.

Mycosis; Aspergillary pseudo-tuberculosis.

Cases are on record where sheep have succumbed from this fungus, which slightly resembles actinomycosis.

Cause: The *Aspergillosis fumigatus.*

Symptoms: Very obscure. As the only cases on record in sheep have been of the pulmonary type, gradual emaciation is the only clinical sign.

Treatment: None practical. Twenty-grain doses potassium iodid three times daily will do as much good as anything.

17. Spirochetes.

While of no practical importance to the clinician, it may be mentioned that the *Spirochæta ovina* has been found in South African sheep.

The parasite is found in the blood-plasma, and is of a corkscrew shape, having nearly half a dozen spirals. The exciting organism is believed to be in the red corpuscles.

The course of the disease is rapid, and very fatal, death often taking place in less than a week.

18. Trypanosomes.

For information, the following trypanosomes have been found to affect sheep:

Trypanosoma Soudenese, found in Algerian sheep.

Trypanosoma Congolese, prevalent in the Congo Free State.

Trypanosoma Dimorphon, another African organism.

Trypanosoma Nanum, prevalent in South Africa.

Others are occasionally found, but are only important to the investigator.

19. Rare Parasites.

Several other rare parasites infest the digestive tract and circulatory systems of sheep, but they are interesting merely from a scientific point of view, and have no practical significance to the practitioner.

CHAPTER XXV.

POISONS.

Closely approaching in extent the losses among sheep due to parasites are the losses from poisoning. The poisons destructive to sheep naturally fall into three classes, as follows:

A. Mineral Poisons.
B. Vegetable Poisons.
C. Animal Poisons.

On the western ranges whole bands of sheep, numbering several thousand each, have been wiped out in a week, sometimes even in a single day, from eating poisonous plants or drinking water impregnated with some unsuspected toxic matter.

It is a well known fact that certain localities abundantly supplied with springs are uniformly deadly to sheep. Sometimes only one certain pasture or part of a gulch is affected in this way.

PINE TREE GROWING IN SOLID ROCK. Favorite ranges for sheep are on mountainous tracts like this. A sheep will thrive where other animals would starve. When other vegetation is unusually scarce, poisonous plants are more likely to be eaten.

In the mountain ranges a great variety of ore formations occur, such as lead, zinc, copper, silver and gold, salts of which sheep may ingest with their food or drink. Sometimes the poisoning assumes a chronic form, due to the fumes from smelters being deposited on the grass that is eaten by the animals. The diagnosis in these cases is extremely difficult. In sections of the country poisons, such as strychnin, phosphorus and arsenic, are used to eradicate predatory animals or squirrels, and not infrequently are distributed where sheep have access to them or are washed to such locations by surface drainage.

In treating cases of poisoning, one should remember the three cardinal principles of toxicology which consist in administering:

First: Chemical antidotes; substances that render the poison inert.

Second: Mechanical antidotes; substances that surround the poison and protect the absorbing tissues.

Third: Physiological antidotes; substances that antagonize the action of the poison by neutralizing its effects on the animal.

Keeping these facts in mind, one can often use ingenuity in selecting substances with which to treat poisoned animals, where the proper antidote is not to be had, a condition that is often the case since sheep are usually found in the most inaccessible parts of the country.

A. MINERAL POISONS.

1. Acute Lead Poisoning.

Acute lead poisoning is rather rare in sheep, but it sometimes occurs in early spring.

Symptoms: Colic, with bloating; suppression of the urine; slow, wiry pulse, with labored breathing; gradual weakness, followed by convulsions and death within a few hours.

Treatment: Dilute sulphuric acid (a 10 per cent solution of the official dilute acid), commonly called "oil of vitriol," in one dram doses, given in a pint of water, forms insoluble lead sulphate.

Epsom or Glauber's salts in one ounce doses dissolved in a pint of water, or a teaspoonful of sulphur mixed with molasses and smeared on the tongue may be given. A dram of potassium permanganate dissolved in a pint of cold water is always good treatment, and may be administered when the exact cause of the poisoning is not known.

Small doses of morphin, atropin, or glonoin may be given hypodermically, or chloral hydrate may be given per rectum.

Treatment in acute cases of lead poisoning is not very successful, as the animals are usually too badly affected to even drench.

Postmortem appearances: Only slight changes are noticeable; this is especially true of the apoplectic form where the animals are found dying in convulsions.

2. Chronic Lead Poisoning.

This is sometimes seen where lead mines are found, or in the vicinity of smelters where the fumes are blown on the grass.

Symptoms: Gradual emaciation, colic, bluish color around the gums followed by death from general weakness.

One must be guided largely by the history of the case, and this is comparatively easy when one is familiar with the country. Old or working lead mines or smelters may give one a clue as to the cause of the trouble.

Treatment: One-half dram doses of potassium iodid dissolved in a pint of water will hasten the removal of the poison by transforming the lead into lead iodid. Gum acacia in water or raw eggs help to protect the mucous membranes.

Postmortem appearances: Paleness of the intestinal mucosa; ulcers and lead-gray discolorations throughout the alimentary canal.

In a large band of sheep the only practical procedure is a complete change of food and water.

3. Acute Arsenical Poisoning.

Acute arsenical poisoning is very rare in sheep.

Symptoms: Great salivation, eroded tongue, paralysis, stupor, and death in a few hours.

Treatment: Do not give oil. Hydrated iron or even the common iron sulphate in large doses, one-half ounce to a pint of water, may be given. Raw eggs, lime water, sweetened water, sulphur and potassium sulphate are also used. Treatment of acute arsenical poisoning is seldom successful.

Postmortem appearances: Great redness and swelling of the mucous membranes of the alimentary canal.

4. Chronic Arsenical Poisoning.

Chronic arsenical poisoning is sometimes seen after using dips containing arsenic.

Symptoms: Chronic diarrhea, gradual emaciation, and sometimes a short, hacking cough is present.

Treatment: Change of food and water. Iron sulphate in small doses—twenty grains per day—may be given.

Postmortem appearances: Paleness of membranes with a general hydremia. Sometimes the postmortem findings are very obscure.

5. Phosphorus Poisoning.

This is sometimes seen in sections where this poison is used to kill noxious animals, such as squirrels. It usually occurs in the acute form.

Symptoms: Phosphorus poisoning greatly resembles arsenic poisoning in that there is great salivation, a staggery gait, and death from convulsions.

Treatment: One dram copper sulphate (blue vitriol) dissolved in a pint of water; same dosage of potassium permanganate; one tablespoonful turpentine given in mucilaginous solutions neutralizes the poison, changing it into phosphoric acid. Peroxid of hydrogen, lime water, charcoal, and raw eggs are also very useful.

Postmortem appearances: Very similar to arsenical poisoning. In subacute cases no lesions may be observable.

6. Copper Poisoning.

Symptoms: Colic; diarrhea; weakness; slow, wiry pulse.

Treatment: Iron in large quantities; raw eggs; mucilaginous drenches; milk and sulphur.

Postmortem appearances: Inflammation of the intestinal tract is usually present. In chronic light attacks calcareous deposits occur in the kidneys.

7. Zinc Poisoning.

This usually occurs in the chronic form.

Symptoms: Colic; diarrhea; weakness, and general paralysis.

Treatment: Tannic acid in dram doses; sulphur; raw eggs; sugar in water; gums; potassium permanganate.

Postmortem appearances: Paleness and ulcers of the intestinal tract.

8. Mercurial Poisoning.

This is comparatively rare in sheep, although occasionally a sheep herder grows careless and leaves blue ointment lying around so that a lamb or two becomes poisoned.

Symptoms: Salivation; bloody diarrhea; eczema; paralysis, and death from general weakness.

Treatment: Sulphur; iron sulphate; raw eggs.

Postmortem appearances: Signs of inflammation in the bowels, with the liver enlarged, are two symptoms that may help one to arrive at a definite diagnosis.

9. Alkali Poisons.

This includes ammonia, soda, potassa, and salts of these metals. Potassium nitrate, sodium chlorid and sodium sulphate poisoning, being more common than the others, are discussed under separate heads.

Symptoms: Colicky pains; sloughing of the mucous membranes of the mouth and throat; bloody diarrhea, followed by collapse and death.

Treatment: Large quantities of vinegar; raw eggs; demulcents.

Postmortem appearances: Inflammation of the mouth and throat; edema of the larynx.

10. Carbolic Acid Poisoning.

As this is purely an accidental poison, the history of the case will guide one to a correct diagnosis. The odor of the poison, together with the coagulation of the tissues, are very plain symptoms.

Treatment: Alcohol; Epsom salt; Glauber's salt; raw eggs.

11. Mineral Acid Poisoning.

The treatment consists of soapsuds, lime water, baking soda, and an ounce of spirit of camphor may be given as a stimulant.

12. Saltpeter Poisoning.

Treatment consists in giving emollients, such as raw eggs, or mucilaginous gruels. Stimulants, such as spirits of camphor or aromatic spirits of ammonia or whiskey, are indicated, if available.

13. Common Salt Poisoning.

This occurs where sheep have been deprived of salt for a long time and then given it in too generous quantities.

Symptoms: Chiefly a violent gastro-enteritis, with a watery diarrhea and frequent urination. Death occurs in a few hours.

Treatment: Drench with large quantities of water; raw linseed oil; raw eggs, and give spirit of camphor as a stimulant.

14. Epsom Salt and Glauber's Salt Poisoning.

Symptoms: Intense thirst; weakness; watery diarrhea; death in a day or two.

Treatment: Give large quantities of water; raw linseed oil; raw eggs; spirit of camphor, aromatic spirits of ammonia or whiskey as a stimulant.

15. Sheep-Dip Poisoning.

After dipping, some of the animals may show symptoms of trembling, staggery gait, paralysis and death. This may not only have been caused by swallowing some of the solution, but inhaling it into the lungs. The sheepmen are very philosophical about this, and when one or more die they merely shrug their shoulders and take it as a matter of course.

Very little can be done in the way of treatment, for death ensues soon after the appearance of the first symptoms. Alcohol, spirit of camphor, Epsom salt solution all may be given. The poisonous action comes from the cresol content of the dip, the action of which is similar to that of carbolic acid.

16. Fruit-Spray Poisoning.

Instances have been reported of sheep dying in winter from some mysterious malady. No lesions of acute infectious disease were apparent; the feed was bright and clean, and the post-mortem findings only confused the diagnosis.

Upon further examination it was found the alfalfa had been shipped in from fruit-raising districts, and the presence of fruit-tree sprays were suspected. A chemical analysis revealed lead arsenate.

Other common sprays are the Bordeaux mixture (composed of lime and blue vitriol); the Blacklead "40" (one part of nicotin to 800 parts of water) and the common lime and sulphur spray.

This is one reason why in all cases of baffling maladies, a complete change of food is indicated.

17. Lime Poisoning.

Cases have been known where a bunch of lambs have been confined to a rather close room and lime sprinkled on them to make them sneeze to get rid of the lung worms or grub in the head. Quite frequently the cure has been more disastrous than the original ailment.

The antidote for lime poisoning is vegetable acids, of which vinegar is a common example.

18. Petroleum Poisoning.

This is so rare that one should merely remember to give large quantities of stimulants. It is not absorbed to any great extent, but acts as a mechanical irritant to the tissues.

19. Rare Mineral Poisoning.

Every now and then some rarely used mineral poison or a combination of such poisonings is the cause of the death of one or more sheep, usually lambs. The best thing one can do in case several are still living when called is to administer demulcents and stimulants.

B. VEGETABLE POISONS.

Every experienced person is familiar with the losses incurred among sheep from eating poisonous plants. Sometimes only a few are poisoned and die, while in other cases whole bands of several thousand have been wiped out in from a few hours to a few days.

It is a well known fact that most of the losses occur in the early spring when the sheep are hungry for green stuff, or after shipment when the animals are so nearly starved they will eat greedily any plant they chance to come upon.

The two most efficient methods of prevention, therefore, are: First, keep off the range before the grass is abundant, and, second, keep the animals supplied with sufficient food.

In the early spring certain poisonous plants, such as death camas, begin to grow before the grass. The green, succulent shoots are eagerly nibbled and soon trouble ensues. If the animal's rumen is full, and it eats but a few shoots of this plant, usually no symptoms of poisoning follow. That is due to a lack of absorption or the very slow absorption of such minute quantities as to cause nothing more than a slight discomfort.

Old stockmen regard plant poisoning as preventable diseases. Their young herders often grow impatient to be off for the range, but the older heads look wise and say nothing, and remain in winter quarters. When first starting out in the spring, the "old man" will ride ahead and carefully peer over the grazing ground on the lookout for "pizen."

As Glover of Colorado has well said, "Throughout the vegetable kingdom, from bacteria to the mighty oak, we find species of plants poisonous under certain conditions, but few of them poisonous under all conditions." This is further illustrated by the following statements:

1. Some plants are poisonous only at certain stages of growth; for example, the lupine is poisonous at the time of going to seed; larkspur loses its toxic properties at flowering time; death camas is very deadly in the early spring, but later dries up.
2. Unusual conditions and ecological factors may affect the quantity of poison in plants. The wilted leaves of the wild cherry or choke cherry are poisonous.
3. Poison is found in different parts of the plant, such as in the roots of wild parsnips, the seeds of lupine, the leaves of the wild or choke cherry, and the entire plant of death camas and aconite.
4. Variations occur owing to season and the climate. These depend also on cultivation and location.
5. Some animals are more susceptible to poison than others. Three sheep of the same age, size and state of health may eat a few leaves of death camas. One may become violently sick and die in a couple of hours; the second may show signs of slight discomfort and soon recover, and the third may exhibit no ill effects whatever.

Loss from plants may be due to two causes:

1. The actual toxic material contained in the plant itself, such as in the death camas, or
2. The mechanical irritation arising from the sharp points or awns of plants, such as foxtail or bearded barley.

Lambs succumb in either case more quickly than adult sheep, due to the absorbing powers of the abomasum, or fourth stomach, and the greater danger from inflammation of the bowels.

Emergency Treatment.

Every sheep man should be advised to have in his medicine chest one hundred or more powders, consisting of ten grains each of potassium permanganate and aluminum sulphate. Several long-neck pint bottles should be included, and when a sheep gets poisoned, fill the bottle with water and pour the powder into it. Shake well, and give very slowly. Do not set the animal up on its rump to drench it; to do so is to insure traumatic pneumonia, and death. This dose should be repeated in twenty minutes.

Tannic acid in sixty-grain powders should also be carried along, as this is an antidote for many vegetable poisons.

Laudanum, in teaspoonful doses, may be given to quiet the animal and relieve spasms, but treatment at the best is a poor substitute for prevention.

Such measures as slashing the ears and cutting off the tail to bleed the animal, of course, can do no good and are even harmful. There are times when these procedures are useful, but not often in poisonings. Pouring melted lard and other concoctions into the animals usually does more harm than good. This has a tendency to dilute the poison and render it easier of absorption.

Morphin, glonoin, H-M-C and atropin all may be given hypodermically by the veterinarian.

But in all cases of plant poisoning, remember to have on hand the potassium permanganate and aluminum sulphate, the tannic acid, and opium in some form as a hypnotic. Stimulants are often valuable, but when the victim is so far gone as to be unable to swallow, little hope can be entertained for its recovery.

In all cases of vegetable poisoning, the usual treatment given by sheepmen is to administer a large quantity of stimulant, such as several ounces of alcohol or whiskey. In a short time, the animal becomes sleepy, lies still for several hours or more, apparently dead, and then, if recovery takes place, gets up, shakes itself, and trots off, rather weakly, to be sure, but otherwise as if nothing had happened. In many cases, where the exact cause of the poisoning is not known, this treatment may be given with as good results as any.

Preparing Plants for Identification.

Often, the veterinarian desires to send specimens of suspected weeds, herbs, grasses or silage for expert examination. Dr. Pammel, of Iowa, a noted authority on this subject, gives the following valuable suggestions on preparing them:

"In sending plants for identification, have them, as far as possible, with the fruit. Do not send a bundle thrown in a box or bale. Moldy fodder and hay should be sent in a fresh condition in a small paper or tin box.

"The first thing to do is to place the specimens between newspapers, apply a little pressure, and when dry or partly dry, they are ready for mailing. Place them between sheets of paper, and give the date of collection, locality, and name and address of collector.

"The notes on symptoms of poisoning, whether found on low or high ground, etc., can accompany them. If the plant is not poisonous, the query will be answered by letter."

These hints should be carefully followed if laboratory assistance of any value is to be expected.

1. Death Camas.

Botanical name—Zygadenus venenosus.

Common names—Wild onion; lobelia; poison camas; and poison sago to distinguish it from the blue or edible camas.

The leaves are lance-shaped, with a simple stem, and bulb-like root, greatly resembling a tough onion. The flowers are greenish-yellow in color. The toxic principle is an unknown alkaloid.

It is found in all kinds of locations, such as valleys, mountain sides and timber lands. Its habitat seems to be South Dakota, Montana, Idaho, Washington, and parts of Utah, Oregon, Wyoming and California.

One must see this plant growing in its native haunts to get a vivid mind-picture of it. It has caused the loss of thousands of sheep. Instances have been known where over two thousand have died in one day from the effects of this poison.

Symptoms: These greatly resemble strychnin-poisoning in general. The animal becomes very restless from the severe pain. Trembling and frothing at the mouth are next seen. Death usually takes place in one to three hours, and from one-half to two-thirds of those exhibiting symptoms die.

Treatment: Give a drench of ten grains each of potassium permanganate and aluminum sulphate dissolved in a pint of cold water, or water with the chill taken off it. This dose should be mixed up just before using, as it soon loses its strength.

2. Loco.

Botanical name—Astragalus mollissimus [purple loco]; and *Aragallus lamberti* [white loco].

Common names—Rattle weed; loco.

It may be said that when the loco grows in large patches it resembles a field of alfalfa. It is a stemless herb, with numerous leaves, the whole plant being about a foot high.

Its habitat is in the Rocky Mountain region, extending from Montana south to the Mexican line.

Horses are its commonest victims, but occasionally a bunch of sheep become "locoed" to the disgust of the owner.

Symptoms: Are characteristic and are not seen from eating any other weed. The animal steps high and seems to lose control of its legs. It develops an insatiate desire for the weed. Other animals imitate the victim out of curiosity and also become victims of the weed.

Treatment: This is largely preventive. When an animal is seen eating loco with apparent relish, remove it from the band at once. If worth saving it may be given teaspoonful doses of Fowler's solution of arsenic once daily.

Do not turn the animals out on pasture when they are very hungry or in the early spring.

3. Larkspur.

Botanical name—Delphinum.

This does not cause so much loss among sheep as among cattle. There are many varieties, all more or less poisonous. The tall larkspur grows to a height of nearly four feet, with very smooth leaves and blue flowers. Purple larkspur grows nearly a foot high, bearing very beautiful purple flowers.

Its habitat is in the western range country, but it is not thickly distributed.

Symptoms: The animal walks with a stiff, trembling gait. Frothing at the mouth is noticed, and the victim makes a start for the nearest watering place, but often dies before reaching it. The fact that many animals have been found dead around a water hole has set up the mistaken cry that the water was poisoned.

Treatment: Largely preventive. When the animal is found poisoned, place its head higher than the body. Carefully give the potassium permanganate and aluminum sulphate drench. One-twentieth of a grain of atropin may be given hypodermically. For lambs reduce this dosage accordingly.

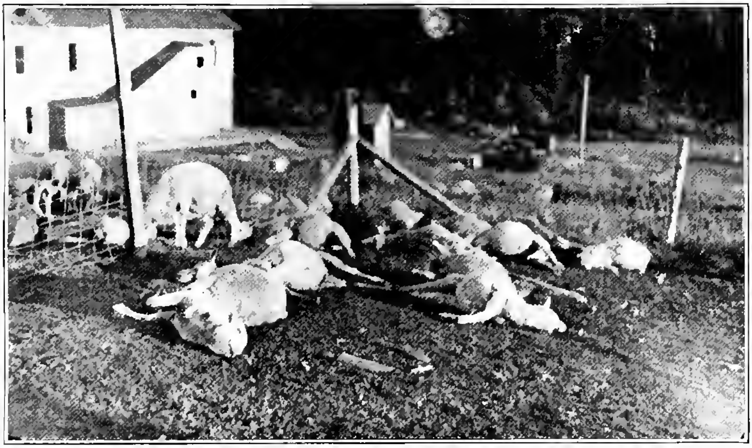
4. Lupine.

Botanical name—Lupinus.

Common names—Wild pea; wild bean; blue bean.

There are several dozen varieties of lupine, all are legumes or members of the pea family, the group to which the clovers and alfalfa belong. None seem to be poisonous until reaching maturity.

The most common lupines are rather tall, with branching forms. The leaves are green above and silver-grey beneath. The flowers vary from blue to white. Its habitat is pretty well distributed over the United States, but it assumes a more poisonous form out in the western range sections.



Sheep Dead from Lupine Poisoning.

Symptoms: The sheep becomes excited; walks in a circle, and butts its head against any intervening obstruction. Paralysis then comes on, and death ends the struggle within a few hours to several days. The general symptoms resemble strychnin poisoning greatly.

Treatment: The potassium permanganate and aluminum sulphate drench may be given. In cases of convulsions, laudanum in teaspoonful doses, or chloral hydrate in two-dram doses, or one-quarter grain morphin hypodermically, may be administered. Acids have been tried also.

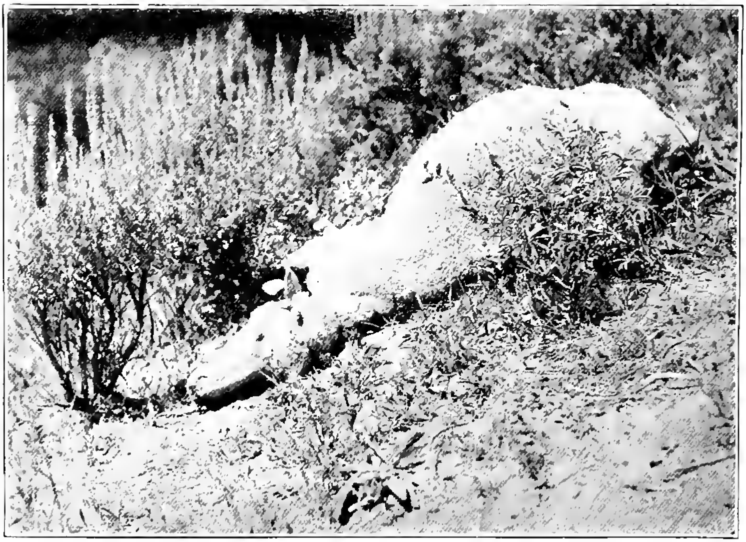
This is not a very common ailment among sheep. In Germany it often assumes the gravity of an enzootic under the name of "lupinosis."

5. Aconite.

Botanical name—Aconitum.

Common names—Monkshood; wolfsbane.

This plant greatly resembles larkspur in that it has a blue flower, but this is "hood shaped." Much confusion exists between this plant and larkspur, and the chances are that owing to its pungent taste aconite does very little actual damage. Several species of aconite occur in the United States, the commonest being the *Aconitum columbianum;* it grows in very high altitudes, up to ten thousand feet, and occasionally a band of sheep, very hungry for green stuff, may eat enough to cause serious results.



Lupine Poisoning—Showing Plant in Foreground.

Symptoms: Muscular weakness, with labored breathing, and a very weak, wiry pulse. Bloating, frothing at the mouth, and, as death draws near, the eye is greatly dilated.

Treatment: One dram (sixty grains) tannic acid dissolved in an ounce of glycerin and a pint of water is the chemical antidote; atropin given hypodermically in one-tenth grain dosage is the physiological antidote.

6. Water Hemlock.

Botanical name—Cicuta occidentalis.

Common names—Cowbane; sometimes called wild parsnip, but differing greatly from the real wild parsnip.

It grows from three to six feet high. Its stem is hollow, green and smooth. The roots are bunched together, and are spindle-shaped, with cross partitions in them. The real wild parsnip has only one thick, fleshy root, which is an easy way to tell the two apart.

The flowers are a dull greenish-white. The plant grows along banks of rivers and marshes, and is pretty well distributed over the West.

It is one of the most deadly of poisonous plants, the toxic matter being found in the root, stem and leaves.

Symptoms: Great abdominal pain, which grows more intense in a few minutes, is the first symptom noticed. Sweating, frothing at the mouth, convulsions, and within half an hour to several hours death takes place in terrible agony.

Treatment: Relief in the great majority of cases is absolutely hopeless. Raw linseed oil, lard, raw eggs, or any agent to soothe the irritated mucous membranes may be given. The potassium permanganate and aluminum sulphate drench may also be administered. Stimulants, such as spirit of camphor, whiskey, ether, aromatic spirit of ammonia or brandy, are indicated.

7. Choke Cherry.

Botanical name—Prunus demissa.

Common name—Choke cherry; choke berry.

This is a shrub with glistening green leaves, not ordinarily harmful, except when famished sheep are driven through thickets of it. It is found usually in gulches. The poison contained in the leaves is hydrocyanic or prussic acid.

Symptoms: The first symptom noticed after passing through one of these cherry thickets is extreme giddiness; labored breathing, with spasmodic contractions of the bowels and bladder. Spasms continue until death ends the struggle. The attack is speedily fatal if the animals eat of these leaves when their stomachs are empty.

Treatment: Largely preventive; the wise sheep man does not allow his sheep access to the leaves while they are very hungry.

Throwing cold water on the head, with inhalations of ammonia, and the hypodermic injection of one-tenth or one-twentieth grain of atropin is about all that can be done. Even this must be done immediately, and therefore by the herder, to be of any avail.

8. Laurel.

Botanical name—Kalmia angustifolia; kalmia latifolia.

Common names—Laurel; sheep laurel; lambkill, and in the southern states, ivy.

It is a common plant in the eastern part of our country, growing in the woods with great profusion. It is a shrub with a pink flower. It is eaten only when the animals are famished for food or green forage.

Symptoms: Frothing at the mouth; labored breathing; loss of sight; paralysis; coma and death.

Treatment: The potassium permanganate and aluminum sulphate drench may be given at once, and one-twentieth of a grain of atropin hypodermically. Usually the animal is beyond recall when discovered.

9. Veratrum.

Botanical name—Veratrum viride or speciosum.

Common name—Hellebore, Indian poke root.

A stout, coarse plant growing about three feet tall. The leaves are broad, with greenish-white flowers. It is found in moist land. Very little attention need be paid this plant, as sheep will not touch it; a lamb, though, may nibble at it out of mere curiosity and later regret it.

Symptoms: Frothing at the mouth; diarrhea; labored breathing; bloat; great abdominal pain, and death within a short time.

Treatment: One dram (sixty grains) of tannic acid dissolved in an ounce of glycerin and a pint of cold water may be given to form an insoluble precipitate, or raw linseed oil, lard, or raw eggs to soothe the mucous membrane.

10. Ergot.

Botanical name—Claviceps purpurea.

Common name—Smut.

Ergot is a black parasitic growth found on various grasses, being very prevalent on both wild and tame rye. The dust-like, powdery pod is familiar to all.

Its greatest danger is to pregnant ewes, a very small quantity being capable of producing abortion. Sometimes it causes serious losses to a band of sheep by being thickly distributed through the hay.

Symptoms: The animal exhibits symptoms of painful swallowing, gulping as though it were choked. The pulse is slow, breathing shallow, and in gangrenous cases the ears become swollen and purple. Paralysis comes on gradually, death taking place quietly, as though the animal were tired of life.

Treatment: Immediate change of food. One dram of tannic acid (sixty grains) dissolved in a pint of water, to which is added a teaspoonful sweet spirit of nitre. The latter will neutralize the action of the poison in the blood to some extent, while the tannic acid renders the ergot in the stomach inert. Cutting off the ears or tail is sometimes indicated. Painting the necrosed areas with balsam of Peru will help these to heal, in case of recovery.

11. Deadly Nightshade.

Botanical name—Solanum nigrum.

Common name—Deadly nightshade.

A smooth, wide-branching weed, growing one or two feet high, with clusters of white flowers. The berries, which ripen along in the late summer, are black, almost round, and very juicy. It is common to all sections of the United States.

Symptoms: Giddiness; dilated pupils; great abdominal pains; convulsions, followed by paralysis and death.

Treatment: As this very rarely causes death in sheep, treatment is a secondary consideration. A teaspoonful of soda dissolved in a pint of water may be given, and stimulants, such as whiskey, sweet spirit of nitre or ether, are indicated.

12. Woody Aster.

Botanical name—Xylorhiza Parryi [Gray].

This plant, found in Wyoming, and growing on gumbo-clay soil, has killed many sheep in the past. It is infected with a fungus, and whether this contains the toxic ingredients or the plant itself is poisonous, has not yet been determined.

It is a medium-sized plant, blossoming about the first of May, and grows less poisonous with age, being entirely inactive when withered.

The poison is very fatal to sheep, from ninety to one hundred per cent of the affected animals dying in spite of all treatment.

Symptoms: From one to several hours after eating the plant. depending on the fullness of the first stomach, the animal begins to grow weak; labored breathing is noticed; then bloating, with frequent urinating. Later, a diarrhea sets in, the eyes become dilated, and the animal dies in from several hours to three or four days.

Treatment: No successful line of treatment has yet been worked out. Stimulants, such as one-half ounce aromatic spirits of ammonia in a cup of warm water; dram doses of oil of peppermint in a half-pint raw linseed oil; dram doses of laudanum in oil, have all been tried with varying success.

The best line of treatment is prevention, and avoiding aster patches when the sheep are hungry, especially in the early spring.

13. Sneeze Weed.

Botanical name—Helenium montanum.

This belongs to the sunflower family, growing from one to three feet high. It has long, lance-shaped leaves, with bright yellow flowers.

It is a very bitter weed, and sheep will not touch it unless almost starved. Sometimes, however, a young animal will develop a taste for it. It has recently been found to be the exciting cause in "spewing sickness" in Utah.

Symptoms: Spasms; rapid pulse; labored breathing, and extreme sensitiveness of the skin. There is sneezing and coughing, and death ends the clinical picture.

Treatment: If observed before convulsions take place, a pint of melted lard may be given. Removal from infected pastures is the only logical procedure. The weed is very abundant on old, worn-out ranges, and is mute testimony to the folly of overgrazing.

14. Rubber Weed.

Botanical name—Hymenoxys floribunda.

Also known as "pingue", the Spanish name of the weed.

This is a small weed, bearing a yellow flower, and is found in the semi-arid ranges of southern Colorado and northern New Mexico. It contains no poisonous principle, so far as known, but causes death by forming a rubber-like obstruction in the intestinal tract.

Symptoms: The animal appears drowsy, and loses its appetite. It lies down and refuses to get up. Death takes place in from one to several hours after the first symptoms are noted.

Treatment: As this is a very obscure disorder, treatment is still in the experimental stage. It has been found through practical experience that a pint of warm brine given every hour will do as much or more good than anything yet tried. This may have a tendency to dissolve the mass.

15. Strychnin.

This is an accidental poisoning, the plant not growing in this country. The trouble usually follows attempts to poison noxious animals, and the sheep may get enough to kill them.

Symptoms: The signs of strychnin poisoning are familiar. First is noticed a restlessness, labored breathing, rapid, wiry pulse, and the animal walks as though it were on stilts. The muscles twitch, the eyes become bloodshot, and there is frothing at the mouth. Convulsions set in and the animal dies with spasmodic twitching of the limbs.

Treatment: One dram (sixty grains) tannic acid dissolved in glycerin and water, an ounce of the former to a pint of the latter, followed by two drams chloral hydrate dissolved in a half-pint of water or given per rectum. Morphin in one-fourth grain doses may be given hypodermically. Raw eggs are excellent, while raw linseed oil or melted lard seems to assist in keeping the poison from being absorbed.

16. Western Golden Rod.

Botanical name—Solidago spectabilis.

Found in the northern parts of the United States. Due to its acrid properties, sheep will eat this plant only when very hungry.

Symptoms: In the acute type, due to eating much of the plant when the stomachs are empty, as occurs when sheep are unloaded after a long railroad journey, maniacal symptoms may occur. Death quickly results.

The subacute, following the ingestion of a rather large quantity on a partly full rumen, creates cerebral excitement, followed by depression, coma and death.

The chronic type, found when the pasture gets very short, and the animal eats just enough to keep it alive, the first thing noticed is a lessened activity, later depression, paralysis, and finally death.

Treatment: A change of food, of course, is the first thing to supply. Those in a state of excitement or showing nervous symptoms may be given a dram or two of chloral hydrate dissolved in a little glycerin and water, orally or per rectum. Lobelin, morphin, hyocyamin or any of the hypodermic sedatives might be tried.

17. Grease-wood.

Botanical name—Sarcobatus vermiculatus.

Grease-wood is a very common shrub in the Rocky mountain region, extending from Montana through Wyoming, Colorado, and Nevada to New Mexico. Its branches are sharp and spinous, and it grows particularly well in dry, alkaline soils.

Symptoms: More or less general in character, and the presence of the shrub usually leads to a correct diagnosis. It probably causes an intense mechanical irritation, in addition to its toxic properties. Uneasiness, bloating, frothing at the mouth, convulsions and death is the usual course.

Treatment: Prevention by herding away from grease-wood patches, and keeping the animals comfortably full on grease-wood ranges. After the animal has ingested large quantities with an empty rumen, no known treatment is effectual. This is due to the intense gastro-enteritis caused by mechanical irritation. Flaxseed gruel, raw eggs, magnesia, acacia or any emollient may be tried, later followed by permanganate of potash and powdered alum to neutralize any toxins.

18. Cockleburr.

Botanical name—Xanthium canadensis.

Cockleburrs do most damage to sheep by lodging in the wool, and in the West probably destroy over a quarter of a million dollars' worth of wool annually.

Cases have been known where poisoning occurred from eating the plant when it had reached the two-leaved stage. However, other forage must be very scarce before sheep will eat much of it.

Symptoms: Abdominal pain; labored respirations, followed by convulsions and death.

Treatment: Ten grains each of potassium permanganate and powdered aluminum sulphate in half a pint of cold water may be given. Later any of the diffusible stimulants, such as teaspoonful doses aromatic spirits ammonia or sweet spirits of niter may be given with white of egg or any emollient.

19. Johnson Grass.

Botanical name—Andropogon halepensis.

A member of the sorghum family, and found extensively in many localities. Its toxic material is hydrocyanic or prussic acid.

Symptoms: When a large amount is ingested in an empty rumen, the animal may suddenly be seized with a convulsion, fall to the ground, its eyes glassy and stary, and in a few minutes fall dead.

In the lighter forms, the pulse will be weak, the respirations slow, panting gasps; later, weakness, and death, unless promptly given an antidote.

Treatment: Place the patient in the shade, with the head slightly up hill. A twentieth grain of atropin may be given hypodermically. If the animal is able to swallow, a half pint of hydrogen peroxide may be given; if unable to swallow, administer it through the canula of a trocar. If the heart action be fluttery, sterile ethereal camphorated oil may be administered hypodermically.

The prussic acid antidote may be made up as follows for instant use: In a pint bottle dissolve two drams sodium carbonate in four ounces water. In another bottle dissolve one dram copperas in four ounces of water. When needed, add the contents of the last mentioned bottle to the first one, shake well and give either as a drench or direct into the rumen by the trocar.

Keeping the animals well fed on other forage in Johnson grass localities will be found the best mode of prevention; then the animal will exhibit no symptoms of poisoning even if it does eat or nibble at a little of this plant.

20. Mullein.

Botanical name—Eremocarpus setigerus.

Commonly known as "turkey mullein". When the range dries up in the late summer, sheep may eat enough of this plant to cause trouble.

Symptoms: Severe abdominal pain, but no convulsions. As in rubber weed this plant forms indigestible balls in the stomach.

Treatment: None known at present. Brine, lard, flaxseed or any common camp remedy may be used with varying results.

21. False Hellebore.

Botanical name—Veratrum californicum.

Commonly called "skunk cabbage." Unless almost starved, sheep will not touch this unpalatable plant.

Symptoms: Frothing at the mouth; labored respirations, followed by convulsions and death.

Treatment: Very unsatisfactory, especially if the stomach be empty and rapid absorption takes place. If seen when the very first symptoms appear, a teaspoonful tannic acid dissolved in glycerin and water may be administered. Fifteen grains each potassium permanganate and aluminum sulphate in half a pint cold water; teaspoonful doses alcohol, aromatic spirits ammonia, spirits camphor, spirits niter, ginger, soda in melted lard or fryings, or any remedy at hand may be given. If the toxin can be neutralized at the start, recovery may take place.

22. Stagger Grass.

Botanical name—Chrosperma muscaetoxicum.

Also known as "fly poison," "crow poison," and "fall poison." This has recently been reported poisonous to sheep. It belongs to the lily family, and is found along the Atlantic coast, from New York to Florida. It grows to a height of one to four feet, with narrow leaves and red fruit. Like the death camas of the West, it appears before other vegetation, and the poisoning occurs usually in the early spring.

Symptoms: Loss of appetite; frothing at the mouth; labored respiration, with a subnormal temperature. In a short time the victim begins to stagger, walks with a tetanus-like gait, and appears to be deathly sick. The duration of the illness may be from an hour to a day. In many cases there is a spontaneous recovery after a few hours' coma.

Treatment: As in death camas very little can be done once the symptoms become visible. Half a dram sterile ethereal camphorated oil may be given as a stimulant, and an effort made to keep the animal quiet.

23. Beets and Beet-Tops.

Botanical name—Beta vulgaris.

In the large beet-raising districts of the West, sheep are also extensively produced and fed on beet-pulp or beet-tops. The most important sugar-beet localities in the West are southern Idaho, Utah, Colorado, and the central parts of Montana and Washington, and in California.

In the early fall, the sheep are fed the tops, and later, the pulp from the sugar factories. In some years, this feed is very harmful; in other years, no trouble whatsoever ensues. As to why this is, no satisfactory explanation has yet been given.

An analysis of sugar beet-tops reveals the following composition.

Water	85.67
Proteins	1.69
Fat	0.28
Nitrogen-free extract	7.81
Fiber	1.53
Sand	1.57
Oxalic acid	0.35
	100.00

Symptoms: In sheep these may assume the form of a mild toxemia, characterized by loss of appetite, impaction, followed by diarrhea, and recovery in a few days.

Others may be stricken as in acute poisoning, and enteritis, dysentery, hematuria and convulsions, followed by death may result. Whether molds or oxalic acid cause these mild or severe symptoms has not yet been fully determined.

The anatomical changes are: more or less whitened mucous membranes; the gullet is unusually pale; the intestinal mucosae slightly congested, while the blood is dark and with little proclivity to coagulate.

Treatment: Tablespoonful doses of milk of magnesia may be given every half hour, followed by a little flaxseed jelly. Hypodermic injections of sterile camphorated oil may be beneficial in extreme weakness, while for the intense griping abdominal pains equal parts dioscorea, colocynth and sweet spirits of niter may be given. These will not always prove beneficial, but any carminative is indicated. If the tops are frozen, the trouble seems to be much aggravated, and warm, stimulating medicines are of use, such as peppermint, ginger, aromatic spirits of ammonia, alcohol and cajuput.

To prevent this form of forage poisoning, sprinkling ordinary slaked lime over the beet-tops will neutralize the oxalic acid and also the molds, if present.

24. Vetch.

Botanical name—Vicia villosa.

This is commonly called "hairy vetch." The Dakota vetch, a very hardy variety, and also a native of the Northwest, possesses the botanical name of *Hosackia purshiana.*

Poisoning occurs when vetch is over-ripe and heavily podded, or when the season has been unusually damp and the growth rank.

Symptoms: Loss of appetite; dullness, and later, coma. The urine possesses a characteristic odor, while constipation may be present. The temperature may be subnormal.

The chief anatomical changes will be found in the liver, which is of a whitish-yellow color, and in the intestinal mucosae, which will be found slightly congested.

Treatment: In light cases, silage has been found excellent, the acid of the latter acting as a neutralizing agent and appetizer. To relieve the constipation one ounce fluid extract cascara sagrada in a half pint of mineral oil, may be given once or twice daily for several days. This acts as a mild, but thorough laxative. Flaxseed jelly may be combined with this, and is soothing to the gastro-intestinal mucosae.

In severe cases, fifteen grains each of potassium permanganate and aluminium sulphate in half a pint of cold water may be administered.

25. White Snake-Root.

Botanical name—Eupatorium urticaefolium.

Also known as "richweed," "deer-wort," "squaw-weed," "white-top," boneset and Indian sanicle.

It is found in eastern parts of the United States, being a rather slender plant. several feet in height, with broad leaves.

It is thought by some to cause "milk sickness," "slows," "tires," and other colloquial names, especially in the southern states.

Symptoms: Muscular tremors around the nostrils and region of the legs are first noticed. After exercise, this is very marked, the animal falling to the ground, as if from exhaustion. There is marked depression, normal temperature, and bloody feces.

The duration of illness is from one to three days, on the average.

The chief anatomical changes are to be found in the intestines, which look as though a severe enteritis had been present, and the liver is greatly congested.

Treatment: No medicinal treatment has proved successful. In light cases, a diet of green corn and pumpkins has given fair results. To relieve the constipation, five grains each of barium chlorid and tartar emetic given in half a pint lukewarm water morning and night, may be tried. Other cathartics are too slow acting.

26. Fern.

Botanical name—Pteris aquilina.

Also known as "bracken."

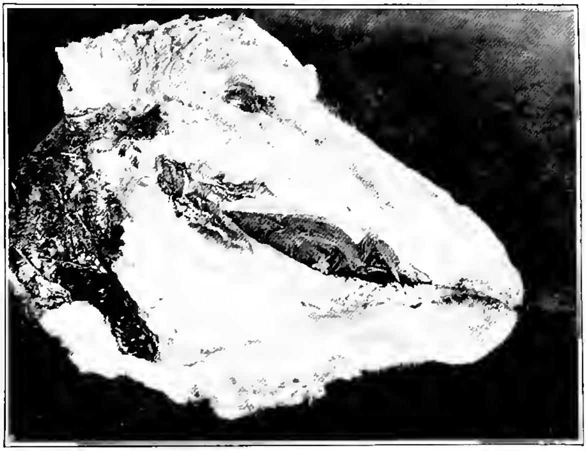
These are widely distributed, being commonly found in the low, moist altitudes of the Pacific coast, as well as in the high, arid regions further inland. They cause many forms of illness, such as hematuria, enteritis, and when covered with molds, severe forage poisoning.

Symptoms: In light cases, where the animal has merely picked up a few succulent ferns, hematuria may be present. Later, severe abdominal pain may appear.

In severe cases, convulsions, frothing at the mouth and death soon ends the agony. Constipation, followed by a bloody diarrhea is the usual clinical course.

Treatment: In the severe cases, not very much can be done, but a correct diagnosis may prevent further losses. The potassium permanganate and alumnium sulphate in fifteen-grain doses may be tried, together with hypodermic injections of camphorated oil.

In the lighter cases, a complete change of hay or pasture should be given. Bright alfalfa sprinkled with lime is beneficial. Flaxseed jelly may be given as an emollient.



HORDEUM JUBATUM—Foxtail Awns Embedded Around Teeth.

27. Western Laurel.

Several different varieties cause poisoning in sheep, and are found as follows:

The northwest laurel (*Menziesia glabella*) found growing more commonly on the north slope of mountain sides in the northwestern states.

The black laurel (*Leucothea dansiae*) of the Sierras of northern California.

The white laurel (*Azalea occidentalis*) is found at lower altitudes in the Sierras than the black laurel.

The Rhododendron is found also in the northwestern mountains, and sheep will eat this herb when other forage is unobtainable.

Symptoms: The animal becomes weak; loses its appetite; later, staggers, attempts to vomit; goes into convulsions, and dies. Frequently, it grinds its teeth, and the herders give the unfortunate victim a wide berth, as they fear it has "fits", or has gone "mad."

Treatment: None so far has proved successful in the later stages. The best known method is to avoid these infested ranges, particularly when the sheep are hungry, and pasture is short. Any line of treatment may be tried, as all so far, have been experiments.

28. Milkweed.

Botanical name—Asclepias.

There have been a few reports of sheep becoming poisoned on this common plant, but no data on the symptoms, antidotes or termination are available.

As these plants are very acrid, sheep will feed on them only when given an exclusive diet of mountain air and scenery.

29. Oak.

Botanical name—Quercus gambellii and *Quercus havardi.*

Extensive feeding on oak leaves sometimes leads to a fatal termination, due to impaction. This is evidently caused by the tannic acid.

Symptoms: As in ordinary cases of impaction; rather intermittent, periods of uneasiness, and stretching as if to urinate or defecate.

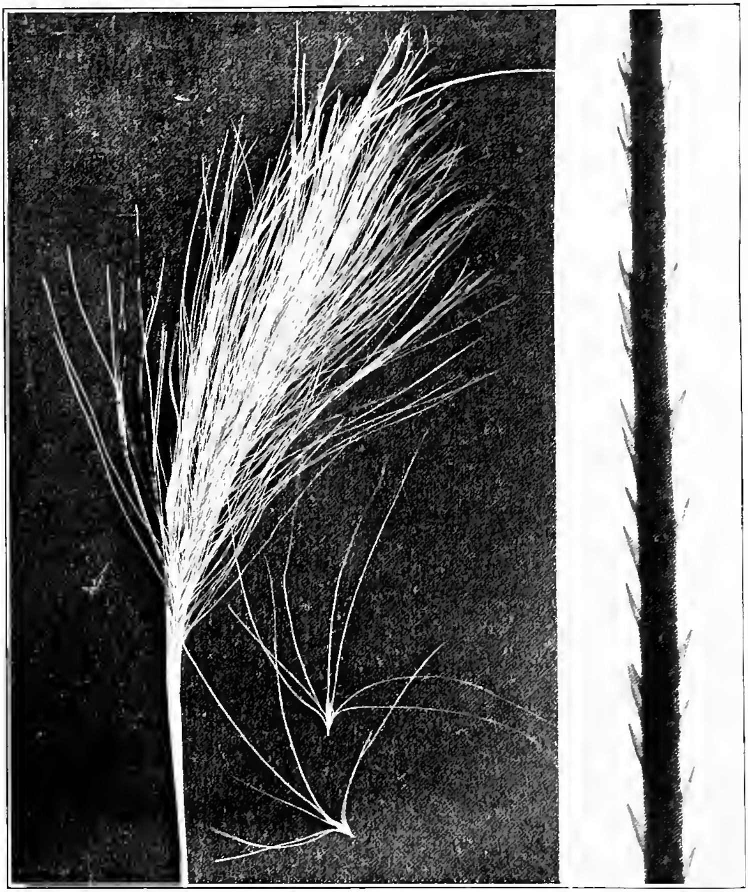
Treatment: Ten grains each of potassium permanganate and aluminum sulphate in a half pint cold water may be given at once to neutralize any toxic materials. Later, five grains each of barium chlorid and tartar emetic may be given every three hours. Teaspoonful doses sweet spirits of niter, or ten drops of tincture of iodin may be given in a two-ounce syringe full of water every two hours. Slow cathartics as oils, salts and the like seem to have little effect.

30. Wild Barley.

Botanical name—Hordeum jubatum.

Often called "squirrel-tailed grass."

This causes a mechanical irritation of the gums, cheeks, nostrils and even the suborbital glands. If not removed, death will sometimes occur in the most severe cases.



HORDEUM JUBATUM (*Foxtail*). At the Right Is Shown a Single Awn of the Hordeum Jubatum, Greatly Enlarged.

31. Cheat.

Botanical name—Bromus tectorum.

This is also known as brome grass, and is found in the Rocky Mountain plateau, particularly in Colorado and Utah.

It merely causes irritation to the tissues with which it comes in contact.

32. Needle Grass.

Botanical name—Stipa cornata.

Found just east of the Rocky Mountains. The sharp seeds pierce the oral membranes, and have been known to cause a fatal enteritis when ingested in large quantities.

Eye Destroyed by Foxtail (*Hordeum jubatum*).

33. Stork's Bill.

Botanical name—Erodium cicutarium.

Known in the West as "wild geranium," causing mechanical irritation.

34. Sand Burr.

Botanical name—Cenchrus tribuloides.

A common plant, sometimes causing sores, with the formation of pus and the invasion of maggots.

35. Burdock.

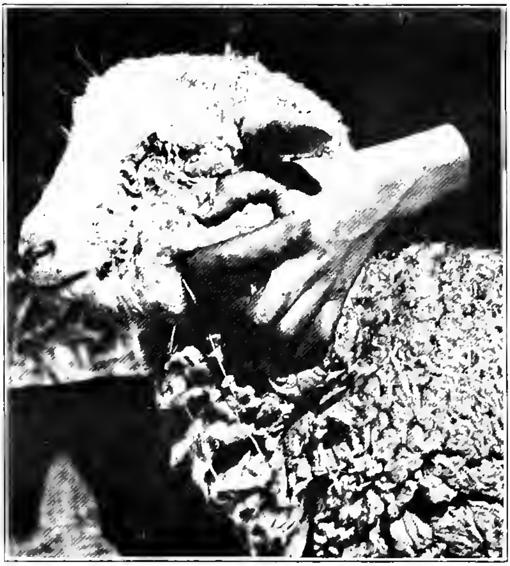
Botanical name—Lappa major.

Another common plant, whose fruit or "burrs" sometimes produce irritation to the skin or loss of wool when they work into the fleece.

37. Spanish Needle.

Botanical name—Bideus frondosa.

This common weed found in the eastern parts of our country may cause much trouble by working into the suborbital glands, ears and interdigital glands. Cases have been known where one needle projected from the wool in such a manner as to produce blindness by destroying the cornea.



Multiple Small Abscesses on Sheep Caused by Foxtail Awns.

They also injure the fleece and reduce the value of the wool.

38. Nettle.

Botanical names—The stinging nettle is known as the *Urtica dioica,* and the Western nettle as the *Urtica holosericea.*

These are common plants, and their "stinging" properties well known.

Sheep get mixed up with this weed when running from predatory animals or when frightened from other causes. They will then plunge madly through a bunch of nettles with a resultant dermatitis.

The cause of the intense itching is said to be formic acid, and aromatic spirits of ammonia applied to the parts greatly relieves this irritation.

39. Sheep Sorrel.

Botanical name—Rumex acetosella.

This is a common plant and causes a rather chronic form of poisoning, somewhat like sugar beet-tops, due to the oxalic acid. For further information see Beet tops, on page 255.

40. Algae.

Botanical name—Spirogyra.

Many varieties of algae are known, and are very common. When growing in water troughs, ponds, or pools they are of a greenish hue, and form a scum of the same color.

They are not poisonous as a rule, but often spoil good watering places by their rapid growth. Sheep require pure water and will do without it rather than drink it when contaminated.

To destroy these weeds and keep a water trough free from them, a very slight trace of copper sulphate is required. For practical purposes fill a small muslin sack with this chemical and draw through the water several times a week. Throwing a little lime into the trough is also beneficial.

41. Cotton Seed Meal.

Poison by this valuable food is usually seen where there is too heavy feeding of oil cake.

Symptoms: There is a bloody diarrhea and bloody urine; cramps; bloat, and great abdominal pain.

Treatment: Immediate change of food. Lambs may be given an ounce of castor oil and several raw eggs.

42. Tobacco.

Botanical name—Nicotiana.

Sometimes seen after the use of tobacco or nicotin dips.

Symptoms: Great abdominal pain; frothing at the mouth; diarrhea; bloat; convulsions, followed by paralysis, and death within an hour or so after the first symptoms are noticed.

Treatment: One dram (sixty grains) tannic acid dissolved in a pint of water, to which has been added an ounce of glycerin. Black coffee may also be given.

43. Digitalis.

Digitalis poisoning very rarely occurs in sheep, as the digitalis plant, commonly known as foxglove, is a cultivated drug plant.

The symptoms are variable, and one must know the complete history of the case in order to make a definite diagnosis.

No cure or antidote is known, although the tannic acid drench may be given a trial.

44. Turpentine.

In the western range sections, sometimes when the sheep are almost famished and food is scarce they will eat enough shoots of young evergreen trees to cause turpentine poisoning.

Symptoms: Acute gastro-enteritis; colic; constipation, the pellets voided being covered with a bloody, slimy mucus. The urine becomes bloody and general weakness follows. The course is gradual, sometimes lasting from several days to a couple of weeks.

Treatment: Removal from the offending pasture. Tannic acid in dram doses, together with whole flaxseed jelly to soothe the irritated urinary membranes. Small doses of lead acetate (from five to ten grains) may be given daily.

45. Rape Seed.

This causes inflammation of the bowels, bloody diarrhea, convulsions and death.

The treatment is wholly symptomatic, and when the malady has reached an advanced stage, treatment is hopeless.

46. Croton Oil.

When administered to cure constipation, sometimes an overdose is given. Violent cramps with a watery dysentery follow. Raw eggs, containing teaspoonful doses of laudanum, may be given, but death is the usual sequel.

47. Hemlock.

Botanical name—Conium maculatum.

Hemlock poisoning is very rare; the acrid taste of the hemlock keeps the sheep from eating it, even though they be almost starved. The usual victims are lambs and the end is death.

Symptoms: Convulsions, followed by complete paralysis.

Treatment: While almost always fatal, one may administer one dram tannic acid dissolved in an ounce of glycerin and a pint of water. Spirit of camphor in tablespoonful doses may be given as a stimulant.

48. Flax.

Botanical name—Linus usitatissimum.

In sections where flax is extensively raised, occasional cases of poisoning among sheep have been known.

Symptoms: Colic; diarrhea; convulsions and death.

Treatment: Give the tannic acid drench.

49. Horse Radish.

Botanical name—Cochlearia armoracia.

Sometimes in the early spring, sheep eat too much of this common garden plant, and violent colic and diarrhea follow.

The treatment consists in giving one dram of tannic acid dissolved in a pint of water. Several raw eggs beaten up may be next given to soothe the irritated mucous membranes.

If the horse radish is old and strong the animal will not need to be blanketed to keep it warm, and if it should die the flesh will not need seasoning.

50. Toadstools.

These are never eaten by sheep, but if a lamb nibbles at one, the resulting symptoms are almost maniacal in form. Not much can be done, but a teaspoonful tannic acid dissolved in a cup of water may be given with advantage in some cases.

51. Potato Tops.

The symptoms greatly resemble foot-and-mouth disease, and the tannic acid drench should be tried.

52. Poison Oak.

Botanical name—Rhus diversiloba.

Common names—Poison ivy; poison sumac.

There are a number of varieties in this group, but poisoning rarely occurs in sheep from any of them. In case it does, drenches of raw linseed oil in pint doses seem to do more good than anything else yet tried. The course of the ailment is a lingering one, sometimes lasting more than a week.

53. Kafir Corn and Sorghum.

Losses sometimes occur in sheep in the autumn from turning them into fields from which kafir corn or sorghum have been harvested. The young stubble contains hydrocyanic (prussic) acid, or substances that may be changed into this acid when ingested by herbivora. It is very deadly to cattle and sheep. Hogs seem to be immune.

The only beneficial treatment known is to give a drench of the potassium permanganate and aluminum sulphate, twenty-grain doses of each, dissolved in a pint of water. However, as death often occurs within a very few minutes after the first symptoms of poisoning are shown, treatment is frequently impossible. As kafir and sorghum stubble is not uniformly poisonous it may be worth while to "try" it with only a few sheep, otherwise it is unsafe to turn a band onto such forage. The danger is greater in dry seasons.

54. Bearded Grasses.

A number of grasses such as foxtail, bearded barley or wheat, and others mentioned, cause trouble to sheep by mechanical irritation. A violent gastro-enteritis is often induced by eating them. Sometimes a bunch of the spikes or awns lodge in the mouth under the tongue and the animal starves to death from inability to eat.

When once affected, absolutely no treatment is known that is successful if the irritation occurs in the stomach or bowels. A careful postmortem examination will reveal the cause, and an extensive repetition of the trouble can be avoided by changing pastures.

55. Ensilage.

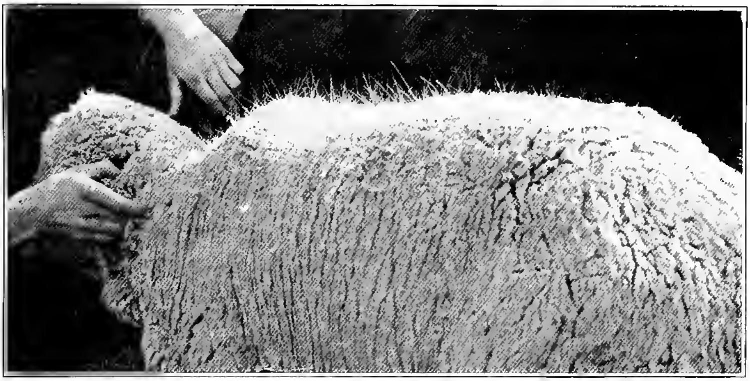
Cases have been known where a large number of sheep have been killed by feeding on moldy silage, or silage that apparently was in good condition, but contained the fungus, *"Penicillium."*

Recent investigations have revealed the presence of Bacillus botulinus in forage poisoning.

The symptoms are the same as from moldy feed of any kind: A violent colic, constipation, followed by fetid diarrhea, convulsions and death.

Treatment is very unsuccessful, since, when the animals begin to exhibit typical symptoms, fatal quantities of the toxic principles have already been absorbed.

Large doses of potassium permanganate, one dram or sixty grains dissolved in a pint of water, may be given. The triple sulphocarbolates, in sixty-grain doses, combined with a dram of tincture of ginger and an equal quantity of dioscorea may also be tried.



Wool Damaged by Foxtail Hay.

If only camp remedies are at hand, give a teaspoonful of powdered ginger, and one-fourth teaspoonful each of salt and pepper dissolved in a pint of lukewarm water. Teaspoonful doses of turpentine in raw linseed oil may be tried, but in cases where there is great inflammation of the mucous membranes of the stomach and bowels, it seems to make matters worse. Raw eggs are always valuable in soothing this irritation.

56. Porcupine Grass.

Botanical name—Stipa.

While over a hundred varieties of this grass are known to botanists, only one, "sleepy porcupine grass," is known to be poisonous to sheep.

This is commonly a native of the Southwest, abounding especially in southern Colorado, western Texas, lower California, Arizona, and New Mexico. It grows at an elevation of from 5,000 to 9,000 feet; is a very hardy plant, about three to five feet tall, with peculiar long, flat leaf-blades, hence the name "porcupine grass." The stalks and leaves are bright green, and the seeds very coarse.

Only when very hungry or when feed is extremely scarce will sheep eat it.

The symptoms of poisoning are insidious, but not particularly fatal. The animal becomes droopy and appears sleepy. Finally, it lies down, and to the inexperienced, the band is minus another sheep. However, in a little while, depending on the amount eaten, the victim awakes and trots off as though nothing had happened.

57. Wild Parsnip.

Botanical name—Pastinaca sativa.

Found in all parts of this country, where it has become wild. It is frequently confused with cowbane, and only a very careful examination by the clinician will reveal the difference. Some years wild parsnip appears very toxic, while in others innocuous. This may be due to a mold. In Australia this is a very poisonous plant, and in this country has been known to produce an intense itch among animals.

Symptoms: Very similar to other plant poisonings, in general. Lack of appetite; intense pain; restlessness; followed by convulsions, frothing at the mouth, and death.

Treatment: If discovered in time, and the animal has not eaten too much on an empty rumen, fifteen grains each of potassium permanganate and powdered alum may be given in half a pint of cold water. Later, stimulants may be administered.

58. Uncommon Plant Poisonings.

Occasionally a plant that is not known generally will cause trouble in some locality. Also, one comes into contact with poison cases that have occurred in almost unheard of manners. Even in the West, on one forest range, a peculiar grass, such as "bear grass," may be found on one side of the mountains, causing much trouble; while on the other side it is unheard of. Many local poisons have not been touched upon for the reason that space forbids.

It requires often the utmost skill to unravel cases that at first defy diagnosis. Eliminating spoiled food, acute infectious diseases, parasites, nearly all range enzootics can be traced to some poison ingested in the food or water.

In every case where the diagnosis is shrouded in mystery, the sheep should be moved to other quarters and given different food and water. These two precautions will often work wonders. An investigation may then be made.

In some parts of the northwest, two plants found among the foothills of the summer ranges have been condemned by sheep men as poisonous. These are the scutellaria or skullcap, and a form of wild pea, with small white flowers. Poisoning from these usually occurs in the early spring, and perhaps they are only harmful when ingested in large quantities by a hungry animal.

In the eastern part of the United States, poke-root, corncockle, horse nettle, jimson weed, horse chestnut and the castor bean have all caused occasional deaths among sheep. Such cases are not common, however, and the animal is dead before discovered, as a rule. The treatment for these cases, if they are discovered in time, consists of large doses of tannic acid dissolved in water.

In the central states, especially in the river valleys, wild or blue pea has caused some fatalities. It may be said, with safety, that almost every vicinity, even neighborhood, where sheep are kept, has its peculiar poisonous plants.

In all cases, however, the treatment is nearly the same. Large doses of some form of alcohol, tannic acid, or potassium permanganate may be given.

C. ANIMAL POISONS.

Sheep are practically immune to this class of poison, as under this head are found snake bites, insect stings, caterpillars and grubs taken in the food, and cantharides or Spanish fly.

As the sheep is such a dainty eater it is not troubled by ingesting animal poisons, and the others have no deleterious effect on the sheep.

In times past fear of snake bites has caused much trouble to sheep-herders, as it compelled them to carry for self-protection large quantities of whisky, much against their will.

However, venomous snakes have heard the voice of legislation, and have ceased their depredations.

In bona fide bites, nothing has been found superior to slashing the wound to cause it to bleed freely, and placing in the incision powdered potassium permanganate.

CHAPTER XXVI.

PREDATORY ANIMALS.

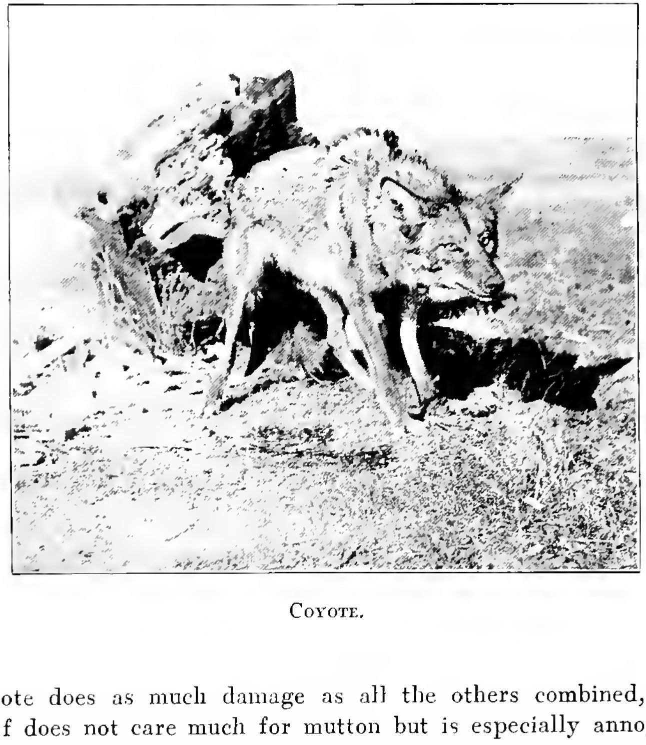
While all live stock suffers from the depredations of predatory animals, the sheep man is a heavier loser than the owner of other domesticated animals. In the eastern states the mongrel dog has nearly ruined the industry; in the western states, where sheep are raised by the million, a varied assortment of animal pests annoy the stockmen.

Notwithstanding the bounties given by both the state and live stock associations, it is not exaggerating to say that over five million dollars' worth of sheep are destroyed annually by predatory animals, in the west alone. Some years ago, when California offered a bounty of five dollars per coyote, over 70,000 were killed in one year, and to keep from being bankrupted, the state repealed the law. In 1915, in less than nine months, nearly 15,000 coyotes were killed in Idaho and presented for bounty and the appropriation exhausted. Because these campaigns against predatory animals have been only sporadic these animals

COYOTE KILLERS—The Russian wolf-hound is a favorite with coyote hunters.

have been allowed to increase enormously during the past few years and become a serious menace to the live stock industry. If every state would offer a uniform bounty for the next ten years, these marauders would soon be practically exterminated.

The chief predatory animals are the coyote, lynx, wild cat, cougar and wolf. The bear is not classed as a sheep-killer but is grouped in bad company, and prairie dogs are a nuisance in destroying the grass on the range where they abound. The coyote does as much damage as all the others combined, the wolf does not care much for mutton but is especially annoying to cattlemen. It is a common estimate in the west that a coyote destroys $100 worth of property a year, and a wolf $1,000. The mountain lion or cougar is the particular enemy of deer, one cougar killing, on the average, fifty of these beautiful, timid animals a year. Only one bear, perhaps, out of a hundred turns "meat eater" and harms the stockman.



Coyote.

1. The Coyote.

"Th' durndest, sneakin'est reptile thet lives" is the unanimous verdict of all western stockmen. This animal is a member of the dog family, and has all the cunning attributes claimed for him by disgusted "buckaroos" who have exhausted their patience in trying to shoot, trap or poison him.

While civilization drives other wild animals still further back into the mountains, the coyote seems to appreciate the coming of the emigrant. With the greatest enjoyment he feasts on fat lamb or veal, and no cleric relishes chicken any better than he. In the most unlooked for places, sometimes not forty rods from the barn, the coyote rears a husky family of five to ten young, and manages to support them in comfort and affluence despite the high cost of living, which because of him is made even higher for all meat consumers.

Wild Cat.

In the spring the coyote welcomes lambing time, and when the band of sheep are driven to the summer range he accompanies the outfit. Many a lamb in straying too far from its mother provides a juicy dinner for the unseen but ever-present coyote. In the fall, he returns, invigorated after a summer vacation in the mountains, and dines with regularity on turkey. duck or chicken. Too cunning to be trapped, too wily to be shot, the best way to get rid of him is to run the brute down with hounds.

In the past few years, in the northwest, coyotes have been spreading rabies to an alarming extent. Due to this, the Federal government is just starting an all-western campaign against this animal, the worst enemy of the stockman in general, and the sheep-raiser in particular.

Lynx Cat Caught in Trap—Sopris National Forest, Colorado.

2. Wild Cat and Lynx.

A "bobcat" getting among a band of sheep seems to kill for the sole pleasure of killing. A hundred or more sheep will be found dead, untouched, save for the gash in the throat.

Bobcats are very cowardly and shy, and for this reason do not do a great deal of damage. Still, one bobcat with a taste for blood will make life a tragedy for any sheepman until it is destroyed. Bobcats are rather easily treed with good dogs; then they may be knocked in the head amid great rejoicing.

The Old Wolf Shot and Helpless.

Wolf Pups Sunning in Front of Den.

3. Wolf and Cougar.

Fortunately for sheepmen these two animals do not seem to relish mutton as much as they do deer. cattle and horses.

The wolf is especially troublesome to the cattleman, and often kills for mere pastime. It is very difficult to destroy, being almost as cunning as the coyote. They breed rapidly, and some sections of the west are so infested with them it is almost impossible to raise horses or cattle.

The cougar or mountain lion is a great coward, and shuns civilization. It does great damage to deer, and occasionally one develops a taste for young lamb. They usually stay close to some body of water where the deer come to drink, and kill one or two a week.

A Sheep-killing Bear.

The best way to hunt cougar is with good hounds, for when treed they make little effort to get away, resembling a cat in this respect. They are very powerful; one who has looked into the sneering face of a cougar treed by several dogs will never forget the sight.

4. Bear.

This harmless animal is the victim of a bad name, due to an occasional bear turning "meat eater" and destroying stock with frightful rapidity. The average bear, however, attends strictly to his own business, and keeps away from the white man as though the latter were a bill collector.

Bears are often mischievous, and sometimes a sheepherder will return to his camp to find his light-housekeeping outfit slightly mussed up and worse from wear after the visit of a prowling bear. The bacon and sugar will be among the things missing, and much profanity will be indulged in by the outraged herders.

As a rule bears are not predatory animals and should not be classed as such.

5. Prairie Dog.

This pest merely destroys the range. It has been estimated that thirty-two of these busy little animals will eat as much grass as one sheep, and as a single village contains thousands of these rodents, it can readily be seen how destructive they really are.

They are combated with poisoned grain, and in the early spring, when the grass is scarce, this method kills them by the thousand.

Federal Campaign Against Predatory Animals.

Realizing the depredations committed by predatory animals in the western states, the federal government has undertaken a campaign against these marauders. It has employed some 200 hunters on full salary. In one year, these men killed 60,458 coyotes, 8,085 bobcats, 1,829 wolves, 201 mountain lions, 137 bears, and have been instrumental in poisoning thousands of others. In addition to this, 652,000 acres of prairie-dog infested lands were thoroughly poisoned, and it is estimated over 90 per cent of these range-destroyers were exterminated. In the eastern states, a similar campaign against the mongrel sheep-killing dog is needed.

CHAPTER XXVII.

QUARANTINE AND TRANSPORTATION REGULATIONS.

There was a time not many years ago when all government and state regulations regarding live stock inspection were looked upon as "fool red tape." In "them good old days" an unscrupulous and bull-headed man could drive a band of scabby sheep wherever he desired so long as he kept out of reach of the bullets from angry cattle men or sheep men. State lines, forest preserves, scab eradication, quarantines and supervision of live stock were Greek to him. "They ain't no sech thing as germs," he would laugh and drive on.

But a new era approached. Successful stockmen began to see what quarantine would do in the control of contagious diseases, such as scab. The benefits accruing from laws designed to curb the migrations of lawless, careless men who cared little how much infection they scattered, were self evident. This sentiment grew in favor, until the western sheep-raising states have the most stringent regulations in the country. These laws have been enacted by the sheepmen themselves and are models of clear, common-sense rules, designed to be of the greatest benefit to the greatest number.

It is true there has been friction. Sometimes an officious, undiplomatic "two-bit" government inspector was sent out from the extreme eastern part of our country. Not being familiar with the rough and ready methods of the West he became about as popular as smallpox. In other cases, ignorant and dishonest state officials, appointed through political trickery and not because of merit, made enemies among the better class of sheep men. Oftentimes sheep raisers without any regard or reason for sensible laws caused trouble. These three factors have caused more or less turmoil, but it is fast dying down.

To keep sheep free from scab or other contagious diseases has proved to be the greatest boon to the industry. To be able to call in expert assistance to diagnose some mysterious malady or enzootic at the beginning of the trouble has been of inestimable benefit. To enforce laws designed for the good of the greatest number has been the duty of the government and state.

Within the boundaries of its own borders, the laws of a state are supreme. When movements of live stock occur between the states, constituting "interstate commerce," the Federal government is the master. Therefore, by government regulations, a state that will not conform to reasonable rules cannot ship out of the state into another, and is, therefore, indirectly compelled to comply with Federal regulations, even in matters that are essentially intrastate.

Fourteen years ago over twelve million sheep were dipped under the government supervision per year, while unnumbered thousands were dipped by state officials. The results of this campaign have been so good that but little scab now remains in this country.

Disinfection of Cars, Vehicles and Premises.

Paragraph 4. Yards, and other premises which have contained cattle, sheep, swine, or other live stock affected with any contagious, infectious, or communicable disease shall not be used in connection with the interstate movement of healthy animals until the said yards and premises have been cleaned and disinfected under bureau supervision in accordance with sections 5 and 6 of this regulation.

Method of Disinfection.

Section 5. Paragraph 1. Cars required by these regulations to be cleaned and disinfected shall be treated in the following manner: Remove all litter and manure from all portions of the cars, including all the ledges and framework outside; clean the exterior and interior of the cars; and saturate the entire interior surface, including the inner surfaces of the car doors, with a permitted disinfectant.

Permitted Disinfectants.

Section 6. Paragraph 1. The substances permitted for use in disinfecting cars, boats, other vehicles, and premises are as follows:

(a) Compound solution of cresol, U. S. P., at a dilution of at least 4 fluid ounces to 1 gallon of water.

(b) A permitted "saponified cresol solution" at a dilution of at least 4 fluid ounces to 1 gallon of water.

(c) Liquefied phenol (liquefied carbolic acid) at a dilution of at least 6 fluid ounces to 1 gallon of water.

(d) Chlorid of lime (U. S. P. strength, 30 per cent available chlorin) at a dilution of 1 pound to 3 gallons of water.

Paragraph 2. The use of "saponified cresol solution" as a substitute for compound solution of cresol, U. S. P., as a disinfectant is permitted, provided that such "saponified cresol solution" shall conform to the following requirements:

1. The formula of the product shall employ not less than 28 per cent by weight of linseed oil. Either caustic potash, caustic soda, or a mixture of caustic potash and caustic soda may be used to saponify the linseed oil. The cresol used must be at least 95 per cent pure, and enough of this commercial grade of cresol (cresylic acid) must be employed in compounding the disinfectant to bring the actual amount of cresol in the finished product up to 50 per cent.

2. The product shall remain a homogeneous liquid when cooled to 32° F. It shall contain substantially no unsaponified linseed oil or excess alkali. It shall be readily soluble in cold distilled water. The solution shall be practically clear and shall contain no globules of undissolved oil or cresylic acid.

Federal Regulations Governing the Interstate Movement of Sheep.

Regulation 4.—To Prevent the Spread of Scabies in Sheep.*

Effective on and after July 1919.

(Superseding previous regulations on this subject.)

Interstate Movement of Sheep Prohibited.

Section 1. Paragraph 1. No sheep affected with or exposed to scabies shall be shipped, trailed, driven, or otherwise moved interstate for any purpose except as hereinafter provided.

Paragraph 2. No sheep shall be shipped, trailed, driven, or otherwise moved interstate from the area quarantined for the disease of scabies in sheep except as hereinafter provided.

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*A "rule to prevent the spread of scabies in sheep" is in effect throughout the entire year. This rule prescribes the quarantined area in the respective States, and should be considered in connection with these regulations. Copies of the rule may be obtained from the Chief of the Bureau of Animal Industry, Washington, D. C.

Paragraph 3. All the sheep in a certain flock or shipment in which the disease of scabies is present shall be classed as diseased sheep, and none of them shall be offered for interstate shipment until dipped as hereinafter provided. The practice of "picking" a flock—that is, removing any sheep which are visibly diseased and then offering any portion of the remaining sheep for either inspection or interstate shipment, or both—is directly and positively prohibited.

Shipments for Immediate Slaughter.

Section 2. Paragraph 1. Sheep affected with scabies, which have been dipped once in a permitted dip under the supervision of a bureau inspector within 10 days of the date of shipment, may be shipped or transported interstate for immediate slaughter to a recognized slaughtering center, provided that the following conditions are strictly observed and complied with:

(a) The sheep shall not be diverted en route.

(b) The sheep shall be slaughtered or again dipped within 14 days from the date of the first dipping.

(c) The cars or boats containing the sheep shall be placarded and the billing shall be marked "DIPPED SCABBY SHEEP" in accordance with paragraph 3 of this section.

(d) Upon arrival at a public stockyards the sheep shall be placed in a portion of the stockyards set aside for the receipt of such sheep, and not permitted to mingle with other animals until such time as they are disposed of for slaughter or are again dipped and certified for further interstate movement for purposes other than immediate slaughter.

Paragraph 2. Sheep that are not diseased with scabies, but which have been exposed to the contagion of the disease, may be shipped or transported interstate by rail, without dipping, to a recognized slaughtering center for immediate slaughter, provided that the cars are placarded and the billing is marked "EXPOSED SHEEP FOR SLAUGHTER," in accordance with paragraph 3 of this section.

Paragraph 3. When sheep are shipped for slaughter in accordance with either paragraph 1 or paragraph 2 of this section, the transportation companies shall securely affix to and maintain upon both sides of each car carrying such sheep a durable and conspicuous placard. not less than 5½ by 8 inches in size, on which shall be printed with permanent black ink in boldfaced letters, not less than 1½ inches in height, the words "DIPPED SCABBY SHEEP" or "EXPOSED SHEEP FOR SLAUGHTER," as the case may be. These placards shall also show the name of the place from which the shipment was made, the date of the shipment (which must correspond with the date of the waybills and other papers), the name of the transportation company, and the name of the place of destination. Each of the waybills, conductors' manifests, memoranda, and bills of lading pertaining to such shipments shall have the words "DIPPED SCABBY SHEEP" or "EXPOSED SHEEP FOR SLAUGHTER," as the case may be, plainly written or stamped upon its face. If for any reason the placards required by this regulation have not been affixed to the car or the billing has not been marked by the initial or the connecting carrier, or the placards have been removed, destroyed, or rendered illegible, the placards shall be immediately affixed or replaced, and the billing shall be marked by the initial or the connecting carrier, the intention being that the billing accompanying the shipment shall be marked and the car containing the sheep shall be placarded "DIPPED SCABBY SHEEP" or "EXPOSED SHEEP FOR SLAUGHTER," as the case may be, from the time of shipment until the sheep arrive at destination and the disposition of the cars is indicated by a bureau inspector.

Shipments for Purposes Other Than Slaughter.

Section 3. Paragraph 1. Sheep affected with scabies may be shipped interstate for any purpose after they have been dipped twice, 10 to 14 days apart, in a permitted dip under the supervision of a bureau inspector and are so certified by such inspector.

Paragraph 2. Sheep that are not diseased with scabies, but which have been exposed to the contagion of the disease, may be shipped. transported, or otherwise moved interstate for purposes other than slaughter after they have been dipped once in a permitted dip under the supervision of a bureau inspector and are certified by such inspector to be free from the disease.

Paragraph 3. Sheep in those States of the quarantined area with which the department is cooperating in the eradication of scabies, and which are not affected with or exposed to such disease, may be shipped, transported, or other wise moved interstate for any purpose after they have been inspected by a bureau inspector and found to be free from the disease or exposure thereto and when accompanied by a certificate from the said inspector.

Paragraph 4. Sheep in those States of the quarantined area with which the department is not cooperating in the eradication of scabies and which are not affected with or exposed to such disease may be shipped interstate for any purpose if dipped once in accordance with this regulation at stations where dipping facilities are provided and bureau inspection is maintained.

Movement From Quarantined Area to Free Area and Shipment Therefrom.

Section 4. No sheep shall be shipped, transported, trailed, driven, or hauled in private conveyances from the quarantined area in any State, Territory, or the District of Columbia to the free area in the same State, Territory, or the District of Columbia and delivered to a transportation company for transportation to any other State, Territory, or the District of Columbia unless the sheep have been handled in accordance with this regulation.

Sheep Infected or Exposed in Transit.

Section 5. Paragraph 1. If sheep free from scabies and exposure thereto be unloaded while in the course of interstate transportation on infectious premises they shall thereafter be treated as exposed sheep and their further movement shall be subject to the provisions of this regulation.

Paragraph 2. Sheep shipped interstate under a certificate from a bureau inspector or other sheep which are found en route to be affected with scabies or to have been exposed thereto shall thereafter be handled as diseased or exposed sheep, as provided by the regulation, and the cars or other vehicles, and the chutes, alleys, and pens which have been occupied by diseased sheep shall be cleaned and disinfected, as provided in regulation 1, sections 4, 5, and 6.

Shipments From Public Stockyards.

Section 6. Paragraph 1. Except as provided in this section no sheep shall be shipped or moved interstate from public stockyards, unless for immediate slaughter, without dipping. Where, however, a part or all of the stockyards is reserved and set apart for the reception of noninfected shipments of sheep and is kept free of disease, sheep may be shipped interstate from the noninfectious yards or portions thereof without dipping. If diseased sheep are introduced into the noninfected yards or portions thereof they shall thereafter be handled in accordance with this regulation, and the chutes, alleys, and pens occupied by the said sheep shall be thoroughly cleaned and disinfected.

Paragraph 2. No sheep shall be shipped or moved interstate from any public stockyards where a bureau inspector is stationed for the inspection of live stock for communicable diseases without a certificate issued by such inspector showing that the sheep are free from contagious disease or have been properly dipped: *Provided,* That this restriction shall not apply to shipments of sheep unloaded in transit for feed, water, and rest, and not offered for sale.

Permitted Dips.

Section 7. The dips at present permitted by the department for the treatment, under bureau supervision, of sheep affected with or exposed to scabies are as follows:

Lime-sulphur dip made in the proportion of 8 pounds of unslaked lime (or 11 pounds of commercial hydrated lime, not air-slaked lime) and 24 pounds of flowers of sulphur or sulphur flour to 100 gallons of water.

Nicotin dip containing not less than five one-hundredths of 1 per cent of nicotin.

The dipping bath should be used at a temperature of 95 to 105° F., and must at all times be maintained at a strength of not less than 1½ per cent of "sulphid sulphur" in the case of the lime-sulphur dip, and not less than five one-hundredths of 1 per cent of nicotin in the case of the nicotin dip as indicated by the field tests for such baths approved[1] by the bureau.

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[1] The field test for lime-sulphur dipping baths is described in U. S. Department of Agriculture Bulletin 163. A field test outfit at present approved by the bureau for nicotin dipping baths is that designated for the purpose of identification as "field test outfit N-3."

2. State Regulations.

State laws in regard to sheep are continually changing, due to unforeseen contingencies. The most attention has been given state inspection in the Rocky Mountain region, which is the home of perhaps one-half the sheep in this country.

Anyone interested can secure the latest rules and regulations by applying to the state veterinarian, residing at the capital of his respective state.

Courtesy Agricultural Digest

BLACK-FACED HIGHLANDS IN THEIR NATIVE HOME.

"In summer's heat, and winter's cold,
He fed the flock, and penn'd the fold."

PUBLICATIONS CONSULTED

American Medical Dictionary, by Dorland.
Animal Parasites, by Kaupp.
Essentials of Veterinary Parasitology, by Campbell & LaCroix.
Judging Livestock, by Craig.
Lymphatic Glands, by Godbille.
Manual of Poisonous Plants, by Pammel.
Medical and Veterinary Entomology, by Herms.
New International Encyclopedia.
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